

## 9.1.0 CONSTRUCTION MATERIALS

### 9.1.1 Introduction

This module unit deals with the study of properties of materials used in construction works. The purpose of this module unit is to equip the trainee with knowledge, skills and attitudes necessary to understand sources, manufacturing/production process and use of the construction materials.

### 9.1.2 General Objectives

- By the end of the module unit, the trainee should be able to:
- acquire sufficient knowledge, skills and attitudes to understand properties of the materials in construction
  - appreciate manufacturing process
  - appreciate the use of different materials in construction
  - observe safety measures when using the materials

### 9.1.3 Module Unit Summary and Time Allocation – (44 Hours)

Code	Sub Module Unit	Content	Time Hours	
			Theory	Pract
9.1.01	Introduction to Materials	<ul style="list-style-type: none"> <li>• General Properties of Materials</li> <li>• Classifications of Materials</li> <li>• Mineral and Organic Materials</li> </ul>	1	2
9.1.02	Building Stone	<ul style="list-style-type: none"> <li>• Origin</li> <li>• Classification</li> <li>• Principal Types in Each Class</li> <li>• Production Methods</li> <li>• Defects and Repairs</li> <li>• Tests on Building Stones</li> <li>• Uses of Stones</li> </ul>	2	2

Code	Sub Module Unit	Content	Time Hours		
			Theory	Pract	Total
9.1.03	Timber and Timber Products	<ul style="list-style-type: none"> <li>• Growth and Cellular Structure</li> <li>• Conversion and Seasoning</li> <li>• Defects</li> <li>• Classification of Commercial Timber</li> <li>• Stress Grading</li> <li>• Timber Preservation</li> <li>• Timber Products</li> <li>• Timber as a Construction Material</li> <li>• Tests on Timber</li> </ul>	2	2	4
9.1.04	Clay Products	<ul style="list-style-type: none"> <li>• Types</li> <li>• Manufacturing Process</li> <li>• Glazes</li> <li>• Tests</li> </ul>	2	2	4
10.1.05					
9.1.05	Plastics and Rubbers	<ul style="list-style-type: none"> <li>• Methods of Manufacturer</li> <li>• Plastic as a Construction Material</li> <li>• Forms of Rubber</li> <li>• Properties and Uses of Rubber</li> <li>• Selection of Rubber</li> <li>• Safety Precautions</li> </ul>	1	1	2
9.1.06	Paints and Varnishes	<ul style="list-style-type: none"> <li>• Functions</li> <li>• Production</li> <li>• Types</li> <li>• Application</li> <li>• Defects</li> <li>• Costing</li> <li>• Safety</li> </ul>	1	2	3

Code	Sub Module Unit	Content	Time Hours	
			Theory	Pract
9.1.08	Glass	<ul style="list-style-type: none"> <li>• Types</li> <li>• Manufacturing Process</li> <li>• Properties and Use</li> <li>• Glass as a Construction Material</li> <li>• Fixing Glass</li> <li>• Costing</li> </ul>	5 4	4
9.1.08	Bituminous Products	<ul style="list-style-type: none"> <li>• Types</li> <li>• Manufacturing Process</li> <li>• Properties and Uses</li> <li>• Tests</li> </ul>	5 3	5 3
9.1.08	Cementious Materials	<ul style="list-style-type: none"> <li>• Types</li> <li>• Manufacturing Process</li> <li>• Properties</li> </ul>	2	3
Total			21	23

9.1.01

## INTRODUCTION TO MATERIALS

### Theory

9.1.01T0

#### *Specific Objectives*

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

- a) describe the general properties of materials
- b) classify the common materials used in construction
- c) differentiate between mineral and organic materials

9.1.01C

#### *Competence*

The trainee should have the ability to classify building materials

#### *Content*

9.1.01T1

General properties of materials

9.1.01T1

Classification of construction materials

9.1.01T1

Difference between mineral and organic materials

### Practice

9.1.01P0

#### *Specific Objective*

By the end of the sub-module unit, the trainee should be able to classify the common materials used in construction

#### *Content*

9.1.01P1 Classification of construction materials

## 9.1.02 BUILDING STONES

### Theory

9.1.02T0 *Specific Objectives*

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

- a) explain origin of stones used in construction
- b) explain the classification of stones
- c) describe the principal types of stones in each class and their uses
- d) describe the main production methods of stones
- e) describe various defects and procedure of repairing the defects
- f) outline the procedure of testing stone specimens

9.1.02C *Competence*

The trainee should have the ability to:

- i) identify the principal types of rocks

- ii) identify defects in construction stones
- iii) carry out tests on stones in a laboratory

9.1.02P1

9.1.02P2

*Content*  
 Selection of appropriate stones for various tasks  
 Tests on construction stones

9.1.03

## TIMBER AND TIMBER PRODUCTS

### Theory

9.1.02T1

*Content*  
 Origin of stones used in construction

- geological formation

9.1.02T2

Classification of stones

- geological
- physical
- chemical
- engineering

9.1.02T3

Principal types of stones

- igneous rocks
- sedimentary
- metamorphic

9.1.02T4

Quarrying

- digging or excavation
- blasting
- drilling
- dressing to shape

9.1.02T5

Defects and procedure of repairing the defects

9.1.02T6

Test procedures for stone specimens

### Practice

9.1.02P0

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

- a) select appropriate stones for various tasks
- b) carry our tests on construction stones

9.1.03T0

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

- a) explain the mode of growth and cellular structure of a tree
- b) explain the various methods of conversion and seasoning of timber
- c) identify and classify commercial timbers
- d) explain timber defects and their effects on strength of timber
- e) describe the method of stress grading
- f) explain the preservation of timber
- g) describe the manufacture of timber products
- h) compare timber with other materials as construction materials
- i) describe various tests carried on timber

9.1.03C

*Competence*

The trainee should have the ability to:

- i) identify the various sizes of timber
- ii) identify defects on timber

*Content*

Mode of growth and cellular structure of a tree

Method of conversion and seasoning of timber

Identification and classification of timber

Defects and their effects on strength of timber

Stress grading methods

Preservation of timber

Manufacture of timber products

Comparison of timber with other materials

Tests carried out on timber

**Practice**

*Specific Objectives*

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

- a) select timber for a given task
- b) carry out tests on timber

*Content*

Selection of timber

- hardwood /softwood
- cross section

9.1.03P2

Tests on timber

- tensile
- compression
- cleavage
- density
- moisture content

9.1.04

**CLAY PRODUCTS**

**Theory**

9.1.04T0 -- *Specific Objectives*

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

- a) describe the various types of clay products and their appropriate uses
- b) describe the manufacturing process of clay products
- c) explain the various glazes applied to clay products
- d) state the properties of clay products
- e) outline the procedure of testing clay products

9.1.04C

*Competence*

The trainee should have the ability to:

- i) mix required ingredients to produce a quality clay product
- ii) test clay products in a laboratory

9.1.03P1

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9.1.04T1	<p><i>Content</i></p> <p>Types of clay products</p> <ul style="list-style-type: none"> <li>- bricks</li> <li>- blocks</li> <li>- roofing tiles</li> <li>- flooring tiles</li> <li>- wall tiles</li> <li>- pipes and fittings</li> </ul>	9.1.04P1	<p><i>Content</i></p> <p>Selection of appropriate clay products</p>
9.1.04T2	<p>Manufacturing process</p> <ul style="list-style-type: none"> <li>- raw materials</li> <li>- ratios</li> <li>- process</li> </ul>	9.1.04P2	<p>Laboratory tests of clay products</p> <ul style="list-style-type: none"> <li>- water absorption</li> <li>- salt content</li> <li>- compressive strength</li> <li>- chemical resistance</li> </ul>
9.1.04T3	<p>Glazes</p> <ul style="list-style-type: none"> <li>- salt glazing</li> <li>- opaque glazing</li> <li>- porcelain enamelling</li> </ul>	9.1.05	METALS
9.1.04T4	<p>Properties of clay products</p> <ul style="list-style-type: none"> <li>- tests procedures</li> <li>- water absorption</li> <li>- salt content</li> <li>- compressive strength</li> <li>- chemical resistance</li> </ul>	9.1.05T0	<p><i>Theory</i></p> <p><i>Specific Objectives</i></p> <p>By the end of the sub-module unit, the trainee should be able to:</p> <ol style="list-style-type: none"> <li>a) define the terms used in metals</li> <li>b) identify the common iron ores</li> <li>c) describe the extraction process of ferrous and non ferrous metals</li> <li>d) explain properties and uses of the various groups of non ferrous metals</li> <li>e) explain the forming processes of metals</li> <li>f) describe the heat treatment given to steel</li> <li>g) explain the protection of ferrous and non ferrous metals</li> </ol>
9.1.04P0	<p><i>Practice</i></p> <p><i>Specific Objectives</i></p> <p>By the end of the sub-module unit, the trainee should be able to:</p> <ol style="list-style-type: none"> <li>a) select appropriate clay products for a given task</li> <li>b) carry out laboratory tests on clay products for a given task</li> </ol>		

- h) describe metal alloys used in construction
- i) describe the process of steel production from scrap metal
- j) outline laboratory tests on metals

9.1.05C

*Competence*

The trainee should have the ability to:

- i) form metal into various shapes
- ii) harden steel by heat treatment
- iii) analyse the chemical composition of steel processed from scrap metal

*Content*

- 9.1.05T1 Definition of terms
- 9.1.05T1 Common iron ores
- 9.1.05T3 Extraction processes of ferrous and non ferrous metals
- 9.1.05T4 Properties and uses on non-ferrous metals
- 9.1.05T5 Forming (shaping) of metals
- 9.1.05T6 Heat treatment to steel
- 9.1.05T7 Protection of ferrous and non-ferrous metals
- 9.1.05T8 Metal alloys
- 9.1.05T9 Process of steel production from scrap metals
- 9.1.05T10 Laboratory tests on metals
  - compressive/tensile strength

- fire resistance

**Practice**

9.1.05P0

*Specific Objectives*

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

- a) select metallic materials for a task
- b) carry out laboratory tests on metals used for construction

*Content*

- 9.1.05P1 Selection of metallic materials
- 9.1.05P2 Laboratory tests on metals
  - compressive/tensile strength
  - fire resistance

9.1.06

**PLASTICS AND RUBBER**

**Theory**

9.1.06T0

*Specific Objectives*

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

- a) explain the methods of manufacturing plastics
- b) outline reasons for using plastics in construction works
- c) explain properties and uses of rubber
- d) outline fire and safety precautions



		when using plastics and rubber			
9.1.06C	<i>Competence</i>	The trainee should have the ability to select and use plastics and rubber as construction materials			<ul style="list-style-type: none"> <li>a) explain properties of paints and varnishes</li> <li>b) outline the procedure of surface preparation before painting and varnishing</li> <li>c) outline the procedure of applying paints and varnishes</li> <li>d) outline safety precautions to be observed while working with paints and varnishes</li> <li>e) outline the procedure of material estimation for a job</li> <li>f) explain procedures of remedying defects on paints and varnishes</li> </ul>
	<i>Content</i>				
9.1.06T1		Methods of manufacturing of plastics			
9.1.06T2		Reasons of using plastics in construction			
9.1.06T3		Properties and uses of rubber			
9.1.06T4		Fire and safety precautions			
		<b>Practice</b>			
9.1.06P0	<i>Specific Objective</i>	By the end of the sub-module unit, the trainee should be able to select plastic and rubber materials for construction work	9.1.07C	<i>Competence</i>	The trainee should have the ability to: <ul style="list-style-type: none"> <li>i) prepare surface before painting and varnishing</li> <li>ii) select and apply paints and varnishes to different surfaces</li> </ul>
	<i>Content</i>				
9.1.06P1		Selection of plastic and rubber materials			
9.1.07	<b>PAINTS AND VARNISHES</b>				
	<b>Theory</b>				
	<i>Specific Objectives</i>				
9.1.07T0		By the end of the sub-module unit, the trainee should be able to:	9.1.07T1	<i>Content</i>	Properties of paints and varnishes
			9.1.07T2		Surface preparation
			9.1.07T3		Procedures of applying paints and varnishes
			9.1.07T4		Safety precautions while working with paints and varnishes

- 9.1.07T5 Material estimation for a job
- 9.1.07T6 Remedy of defects on paints and varnishes

### Practice

- 9.1.07P0 *Specific Objectives*  
By the end of the sub-module unit, the trainee should be able to:
- select paints and varnishes for various jobs
  - prepare surfaces before painting and varnishing a surface
  - apply paints and varnishes to surfaces
  - determine the cost of painting and varnishing a surface

### Content

- 9.1.07P1 Selection of paints and varnishes
- 9.1.07P2 Surface preparation
- 9.1.07P3 Apply paints and varnishes to surfaces
- coats
  - tools/equipment
- 9.1.07P4 Determination of cost of painting and varnishing a surface

## 9.1.08 GLASS

### Theory

- 9.1.08T0 *Specific Objectives*  
By the end of the sub-module unit, the trainee should be able to:

- explain the manufacturing processes of glass
- explain properties and uses of various types of glass.
- outline advantages of glass as a construction materials
- state materials used for fixing glass
- outline the procedure of fixing glass

### 9.1.08C

### Competence

The trainee should have the ability to measure, cut and fix glass

### Content

- 9.1.08T1 Manufacturing processes of glass
- 9.1.08T2 Properties and uses of glass
- 9.1.08T3 Advantages of glass as a construction material
- 9.1.08T4 Fixing materials:
- rubber
  - putty
  - beads
- 9.1.08T5 Procedure of fixing glass

### Practice

### 9.1.08P0

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

- a) select materials for glazing
- b) fix glass panes
- c) determine the cost of glazing

- 9.1.09T1 Bituminous materials
- 9.1.09T2 Manufacturing process
- 9.1.09T3 Uses of bituminous products
- 9.1.09T4 Properties of bituminous products
- 9.1.09T5 Procedure of tests on bitumen

- 9.1.08P1 *Content*  
Selection of glazing materials
- 9.1.08P2 Fixing glass panes
- 9.1.08P3 Costing of glazing tasks

**Practice**

9.1.09 **BITUMINOUS PRODUCT**

- 9.1.09P0 *Specific Objectives*  
By the end of the sub-module unit, the trainee should be able to:
  - a) select appropriate bituminous materials for a task
  - b) carry out laboratory tests on bituminous materials

**Theory**

- 9.1.09T0 *Specific Objectives*  
By the end of the sub-module unit, the trainee should be able to:
  - a) describe types of bituminous materials
  - b) explain the process of manufacturing bituminous products
  - c) outline the use of bituminous products in construction
  - d) explain properties of various bituminous products
  - e) outline the procedure of carrying out tests on bitumen

*Content*

- 9.1.09P1 Selection of bituminous materials
- 9.1.09P2 Laboratory tests
  - viscosity
  - stability
  - strength

9.1.10 **CEMENTITIOUS MATERIALS**

**Theory**

- 9.1.09C *Competence*  
The trainee should have the ability to apply bituminous products in construction effectively

- 9.1.10T0 *Specific Objectives*  
By the end of the sub-module unit, the trainee should be able to:
  - a) describe various types of cementitious materials

- b) explain the manufacturer of cementitious materials
- c) use cementitious materials as bonding agents
- c) explain the properties and uses
- d) assemble construction components using cementitious materials
- d) outline the procedure of preparing cementitious materials

9.1.03C

**Competence**  
 The trainee should have the ability to select, prepare and use cementitious materials to bond various construction materials

- 9.1.10P1
- 9.1.10P2
- 9.1.10P3
- 9.1.10P4

**Content**  
 Selection of cementitious materials  
 Preparation of cementitious materials  
 Use of cementitious materials as bonding agents  
 Assembly of construction components using cementitious materials

- 9.1.10T1
- 9.1.10T2
- 9.1.10T3
- 9.1.10T4

**Content**  
 Types of cementitious materials  
 Manufacture of cementitious plaster  
 Properties and uses of mortar  
 Procedure of preparing cementitious materials for use

**Suggested Teaching/Learning Methods**  
 - Discussion  
 - Demonstration  
 - Write notes  
 - Bond various components

**Practice**

9.1.10P0

**Specific Objectives**  
 By the end of the sub-module unit, the trainee should be able to:  
 a) select appropriate cementitious materials for a given task  
 b) prepare cementitious materials

**Suggested Teaching/Learning Resources**  
 - Text books  
 - Manuals  
 - Journals  
 - Tools  
 - Materials

**Suggested Assessment Methods**  
 - Observation