

## 12.1.0 CONSTRUCTION MATERIALS

### 12.1.1 Introduction

This module unit deals with the study of materials and their properties as used in construction works. The purpose of the module unit is to equip the trainee with knowledge, skills and attitudes necessary to identify sources, manufacture/production and use of construction materials.

### 12.1.2 General Objectives

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

- a) Describe properties of various construction materials
- b) Describe processes of manufacturing various construction materials
- c) Select appropriate materials for given tasks

### 12.1.3 Module Unit Summary and Time Allocation

#### Construction Materials

Code	Sub-Module Unit	Content	Time (Hours)		
			Theory	Practice	Total
12.1.01	Introduction to Construction Materials	<ul style="list-style-type: none"><li>• Identification of construction materials</li><li>• General Properties of construction materials</li><li>• Classifications of Materials</li><li>• Mineral and Organic Materials</li></ul>	1	1	2
12.1.02	Building Stones	<ul style="list-style-type: none"><li>• Origin</li><li>• Types</li><li>• Production Methods</li></ul>	1	1	2
12.1.03	Timber and Timber Products	<ul style="list-style-type: none"><li>• Growth and Structure</li><li>• Conversion and Seasoning</li><li>• Classification of Commercial Timber</li><li>• Defects</li></ul>	2	3	5

Code	Sub-Module Unit	Content	Time (Hours)		
			Theory	Practice	Total
		<ul style="list-style-type: none"> <li>• Timber Preservation</li> <li>• Manufacture of timber</li> </ul>			
12.1.04	Clay Products	<ul style="list-style-type: none"> <li>• Types</li> <li>• Uses of clay products</li> <li>• Manufacturing Process</li> <li>• Glazes</li> <li>• Properties</li> </ul>	2	2	4
12.1.05	Metals	<ul style="list-style-type: none"> <li>• Definition of terms</li> <li>• Common metal ores</li> <li>• Properties and uses of metals</li> <li>• Forming (shaping) of metals</li> <li>• Heat treatment steel</li> <li>• Protection of metals</li> <li>• Metal alloys</li> <li>• Process of steel production from scrap metals</li> </ul>	2	6	8
12.1.06	Cementitious Materials	<ul style="list-style-type: none"> <li>• Types</li> <li>• Manufacturing Process</li> <li>• Properties</li> <li>• Uses</li> <li>• Preparation</li> </ul>	2	2	4
12.1.07	Concrete	<ul style="list-style-type: none"> <li>• Materials for manufacturing concrete</li> <li>• Manufacturing processes of concrete</li> <li>• Properties of concrete</li> <li>• Workability test</li> </ul>	2	2	4
12.1.08	Emerging Issues and Trends in Construction Materials	<ul style="list-style-type: none"> <li>• P.P.R pipes</li> <li>• Granito tiles</li> <li>• Gypsum boards</li> <li>• Aluminium rails</li> </ul>	2	2	4

Code	Sub-Module Unit	Content	Time (Hours)		
			Theory	Practice	Total
		<ul style="list-style-type: none"> <li>• Plastic ceiling strips</li> <li>• MDF timber boards imported from China or others</li> <li>• Challenges posed by trends and issues in materials in construction</li> <li>• Coping with challenges</li> </ul>			
<b>Total</b>			<b>14</b>	<b>19</b>	<b>33</b>

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**12.1.01 INTRODUCTION TO CONSTRUCTION MATERIALS**

**12.1.01C Competence**

The trainee should have the ability to classify building materials

**Theory**

12.1.01T0 *Specific Objectives*  
By the end of the sub-module unit, the trainee should be able to:

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

*Content*

12.1.01T1 Construction Materials

- i) stone
- ii) timber and timber products
- iii) clay
- iv) metals
- v) plastics and rubber

- vi) paints and vanishes
- vii) glass
- viii) bituminous products
- ix) cementitious materials
- x) glues and adhesives
- xi) sealants
- xii) fibrous materials
- xiii) concrete

12.1.01T2 General properties of construction materials

- i) mechanical properties
- ii) thermal properties
- iii) chemical properties

12.1.01T3 Classification of construction materials

12.1.01T4 Difference between mineral and organic materials

**Practice**

12.1.01P0 *Specific Objective*  
By the end of the sub-module unit, the trainee should be able to classify the common materials used in construction

*Content*

12.1.01P1 Classification of construction materials

*Suggested Teaching/Learning Activities*

- Discussion
- Question and answers
- Observations

*Suggested Teaching/Learning Resources*

- Text books
- Internet
- Realia
- Site visits

*Suggested Assessment Methods*

- Assignments
- Written tests

- c) describe the production of building stones

*Content*

12.1.02T1 Origin of stones used in construction

- i) geological formation

12.1.02T2 Principal types of stones

- i) igneous rocks
- ii) sedimentary
- iii) metamorphic

12.1.02T3 Quarrying

- i) digging or excavation
- ii) blasting
- iii) drilling
- iv) dressing to shape

**12.1.02 BUILDING STONES**

**Practice**

**12.1.02C Competence**

The trainee should have the ability to identify appropriate building stones for construction

12.1.02P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to select appropriate stones for various tasks

**Theory**

12.1.02T0 *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) describe the principal types of stones and their uses

12.1.02P1 *Content* Selection of appropriate stones for various tasks

*Suggested Teaching/Learning Activities*

- Discussion
- Question and answers
- Observations

*Suggested Teaching/Learning Resources*

- Text books
- Specimens
- Internet
- tools and equipments
- Site visits

*Suggested Assessment Methods*

- Assignments
- Written tests
- Practical excursions

**12.1.03 TIMBER AND TIMBER PRODUCTS**

**12.1.03C Competence**

The trainee should have the ability to:

- Identify the various sizes of timber
- Identify defects on timber

**Theory**

12.1.03T0 *Specific Objectives*

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

- explain the mode of growth and structure of a tree
- explain the various methods of conversion and seasoning of timber
- identify commercial timbers

- describe timber defects and their effects on strength of timber
- explain the preservation of timber
- explain the manufacture of timber products

*Content*

- 12.1.03T1 Mode of growth and structure of a tree
- 12.1.03T2 Methods of conversion and seasoning of timber
- 12.1.03T3 Classification of timber
- 12.1.03T4 Defects and their effects on strength of timber
- 12.1.03T5 Preservation of timber
- 12.1.03T6 Manufacture of timber products

**Practice**

- 12.1.03P0 *Specific Objective*  
By the end of the sub-module unit, the trainee should be able to select timber for a given task

*Content*

- 12.1.03P1 Selection of timber
- hardwood / softwood
  - sizes

*Suggested Teaching/Learning Activities*

- Discussion
- Question and

- answers
- Observations

*Suggested Teaching/Learning Resources*

- Text books
- Specimens
- Internet
- Site visits

*Suggested Assessment Methods*

- Assignments
- Written tests
- Practical assignments

**12.1.04 CLAY PRODUCTS**

**12.1.04C Competence**

The trainee should have the ability to select clay products for building construction

**Theory**

12.1.04T0 *Specific Objectives*

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

- describe the various types of clay products
- describe the uses of clay products
- describe the manufacturing process of clay products

- explain the various glazes applied to clay products
- state the properties of clay products

*Content*

- 12.1.04T1 Types of clay products
  - bricks
  - blocks
  - roofing tiles
  - flooring tiles
  - wall tiles
  - pipes and fittings
- 12.1.04T2 Uses of clay products
- 12.1.04 T3 Manufacturing process
  - raw materials
  - ratios
  - process
- 12.1.04T4 Glazes
  - salt glazing
  - opaque glazing
  - porcelain enamelling
- 12.1.04T5 Properties of clay products
  - mechanical properties
  - chemical properties

**Practice**

- 12.1.04P0 *Specific Objective*  
By the end of the sub-module unit, the trainee should be able to select suitable clay products for building construction

*Content*

- 12.1.04P1 Selection of suitable clay products

*Suggested Teaching/Learning Activities*

- Discussion
- Question and answers
- Observations
- Testing
- Site visits

*Suggested Teaching/Learning Resources*

- Text books
- Specimens
- Internet
- Charts/manuals

*Suggested Assessment Methods*

- Assignments
- Written tests

- c) describe the extraction processes of metals
- d) explain properties and uses of the various groups of metals
- e) explain the forming processes of metals
- f) describe the heat treatment given to metals
- g) explain the protection of metals
- h) describe the use of metal alloys in construction
- i) describe the process of steel production from scrap metal

**12.1.05 METALS**

**12.1.05C Competence**

The trainee should have the ability to select metals for use in construction

**Theory**

12.1.05T0 *Specific Objectives*

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

- a) define the terms used in metals
- b) identify the common iron ores

*Content*

- 12.1.05T1 Definition of terms
- 12.1.05T2 Common iron ores
- 12.1.05T3 Extraction processes of ferrous metals
- 12.1.05T4 Properties and uses of metals
  - i) ferrous
    - cast iron
    - wrought iron
    - steel
  - ii) non – ferrous
    - aluminium
    - zinc
    - copper
- 12.1.05T5 Forming (shaping) of metals
- 12.1.05T6 Heat treatment to steel
- 12.1.05T7 Protection of ferrous and non-ferrous metals



- 12.1.05T8 Metal alloys  
 12.1.05T9 Process of steel production from scrap metals

**Practice**

- 12.1.05P0 *Specific Objective*  
 By the end of the sub-module unit, the trainee should be able to select metallic materials for a task in building

*Content*

- 12.1.05P1 Selection of metallic materials

*Suggested Teaching/Learning Activities*

- Discussion
- Question and answers
- Observations
- Testing

*Suggested Teaching/Learning Resources*

- Text books
- Specimens
- Internet
- Site visits
- Charts/manuals

*Suggested Assessment Methods*

- Assignments
- Written tests

**12.1.06 CEMENTITIOUS MATERIALS**

**12.1.06C Competence**

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

**Theory**

- 12.1.06T0 *Specific Objectives*  
 By the end of the sub-module unit, the trainee should be able to:

- a) describe various types of cementitious materials
- b) describe the manufacture of cementitious materials
- c) explain the properties of cementitious materials
- d) explain the uses of cementitious materials
- e) outline the procedure of preparing cementitious materials

*Content*

- 12.1.06T1 Types of cementitious materials  
 12.1.06T2 Manufacture of cementitious materials

	<ul style="list-style-type: none"> <li>i) lime</li> <li>ii) cement</li> <li>iii) gypsum</li> </ul>	
12.1.06 T3	Properties of cementitious materials	<i>Suggested Teaching/Learning Activities</i>
12.1.06T4	Uses of cementitious materials	<ul style="list-style-type: none"> <li>- Discussion</li> <li>- Question and answers</li> </ul>
12.1.06T5	Procedure of preparing cementitious materials for use	<ul style="list-style-type: none"> <li>- Observations</li> <li>- Practicals</li> </ul>

**Practice**

12.1.06P0	<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"> <li>a) select appropriate cementitious materials for a given task</li> <li>b) prepare cementitious materials for use</li> <li>c) use cementitious materials as bonding agents</li> <li>d) make components using cementitious materials</li> </ul>
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*Suggested Teaching/Learning Resources*

- Text books
- Specimens
- Internet
- Site visits

*Suggested Assessment Methods*

- Assignments
- Written tests
- Practical assessments

**12.1.07 CONCRETE**

**12.1.07C Competence**

The trainee should have the ability to select materials and manufacture concrete

**Theory**

*Content*

12.1.06P1	Selection of cementitious materials
12.1.06P2	Preparation of cementitious materials
	<ul style="list-style-type: none"> <li>i) slaking lime</li> <li>ii) gauging</li> </ul>
12.1.06P3	Use of cementitious materials as bonding agents
12.1.06P4	Make components using cementitious materials

12.1.07T0	<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"> <li>a) describe materials for concrete manufacture</li> </ul>
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- b) describe the manufacturer of concrete
- c) describe the properties of concrete
- d) describe the workability of concrete

- b) mix the ingredients in the manufacture of concrete
- c) manufactures of concrete products
- d) carry out workability test

*Content*

12.1.07T1 Materials for manufacturing concrete

- i) cement
- ii) aggregates
  - fine
  - coarse
- iii) water
- iv) additives

12.1.07T2 Manufacturing processes

- i) batching
- ii) mixing
- iii) transport
- iv) placing
- v) compacting
- vi) curing
- vii) finishing

12.1.07T3 Properties of concrete

- i) wet concrete
- ii) hardened concrete

12.1.07T4 Workability test

**Practice**

12.1.07P0 *Specific Objectives*

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

- a) select ingredients for manufacturing concrete

12.1.07P1 Selection of ingredients for manufacturing concrete

12.1.07P2 Manufacture of Concrete products

- i) blocks
- ii) bricks
- iii) lintels
- iv) paving slabs
- v) coping stones

12.1.07P3 Workability test

*Content*

*Suggested Teaching/Learning Activities*

- Lectures
- Discussion
- Question and answers
- Observations
- Demonstration

*Suggested Teaching/Learning Resources*

- Text books
- Specimens
- Internet
- Charts/manuals
- Material, tools and equipment

*Suggested Assessment  
Methods*  
- Assignments

- Written tests
- Practical tests

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