

19.2.0

**GEOTECHNOLOGY II**

19.2.1

**Introduction**

This module unit involves the study of soils and rocks forming the earth's surface.

It is intended to equip the trainee with the necessary knowledge, skills and attitudes necessary to analyze the properties of soils and rocks for use in construction.

19.1.2

**General Objectives**

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

- understand the properties of soils and rocks
- understand the procedures of carrying out laboratory tests on soils and rocks
- use results of test to perform construction works
- locate sites for construction

19.2.3

**Module Unit Summary and Time Allocation - (33 Hours)**

| Code    | Sub Module Units | Content   | Total Hours |
|---------|------------------|---|-------------|
| 19.2.01 | Weathering       | <ul style="list-style-type: none"> <li>Physical Process</li> <li>Chemical Weathering</li> <li>Effects of Weathering</li> </ul>                        | 2           |
| 19.2.02 | Faults           | <ul style="list-style-type: none"> <li>Terminologies</li> <li>Description of Faults</li> <li>Identification</li> <li>Effects</li> </ul>               | 2           |
| 19.2.03 | Quarries         | <ul style="list-style-type: none"> <li>Types</li> <li>Blasting</li> <li>Excavations Plant</li> <li>Material Selection</li> </ul>                      | 8           |
| 19.2.04 | Tunnels          | <ul style="list-style-type: none"> <li>purpose of rock tunnelling</li> <li>Tunnelling Plant</li> <li>Hazards</li> <li>Safety</li> </ul>               | 7           |
| 19.2.05 | Dams             | <ul style="list-style-type: none"> <li>Purpose of dam construction</li> <li>Factors Affecting Site Selection</li> <li>Problems Encountered</li> </ul> | 8           |

|              |      |  |           |
|--------------|------|--|-----------|
| 19.2.06      | Maps | <ul style="list-style-type: none"><li>• Types</li><li>• Features</li><li>• Drawing of Maps</li></ul> | 6         |
| <b>Total</b> |      |  | <b>33</b> |

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|-----------|--|-----------|---|
| 19.2.01   | <b>WEATHERING</b>  | 19.2.01T3 | Effect of weathering on rocks   |
|           | <b>Theory</b>  | 19.2.02   | <b>FAULTS</b>   |
| 19.2.01T0 | <i>Specific Objectives</i><br>By the end of the sub-module unit, the trainee should be able to:<br>a) describe physical process<br>b) describe chemical weathering processes<br>c) explain the effect of weathering on rocks | 19.2.02T0 | <i>Specific Objectives</i><br>By the end of the sub-module unit, the trainee should be able to:<br>a) explain terms applied to geological structures<br>b) describe features of faults<br>c) explain the criteria for recognition of faults in the field<br>d) explain the geological effect caused by faults |
| 19.2.01C  | <i>Competence</i><br>The trainee should have the ability to:<br>i) assess the effect of weathering on rocks<br>ii) select suitable rock materials considering the extent of weathering that may have effected rock mass      | 19.2.02C  | <i>Competence</i><br>The trainee should have the ability to:<br>i) identify geological formations that are faulted<br>ii) select construction sites that are free from faults   |
|           | <i>Content</i>   |           | <i>Content</i>  |
| 19.2.01T1 | Physical weathering processes<br>- Temperature fluctuation<br>- Frost action<br>- Physical action  | 19.2.02T1 | Terms<br>- fault<br>- fold  |
| 19.2.01T2 | Chemical weathering processes<br>- Hydrolysis<br>- Hydration<br>- Solution<br>- Oxidation<br>- Reduction<br>- Decay biogenic product   | 19.2.02T2 | Elements of a fault<br>- fault plane<br>- upthrow side<br>- downthrow side<br>- foot wall<br>- throw  |



- heave
  - dip
- 19.2.02T3 Fault recognition
- water fall
  - fault breccia
  - change in river course

- 19.2.02T4 Geological effects caused by faults
- lava flow
  - dykes
  - mineralization
  - topographical changes

**Practice**

- 19.2.02P0 *Specific Objectives*  
By the end of the sub-module unit, the trainee should be able to:
- a) recognize faults in the field
  - b) identify geological effects of faults

*Content*

- 19.2.02P1 Fault recognition
- water fall
  - fault breccia
  - change in river course

- 19.2.02P2 Geological effects caused by faults
- lava flow
  - dykes
  - mineralization
  - topographical changes

19.2.03

**QUARRIES**

**Theory**

19.2.03T0

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

- a) explain types of quarries based on nature of rock material to be excavated
- b) explain the influence of rock types on the selection of blasting
- c) explain the influence of rock types on the selection of excavation methods

19.2.03C

*Competence*

- The trainee should have the ability to:
- i) sketch quarrying plant
  - ii) select construction materials

*Content*

- 19.2.03T1 Type of quarries
- hard rock quarry
  - soft rock quarry

- 19.2.03T2 Blasting method
- weak zones
  - mineral zones
  - seismic velocity
  - homogeneity

- 19.2.03T3 Excavation plant
- plasticity
  - bulking
  - load bearing capacity
  - seismic velocity

- weak zones

carrying out tunnelling

### Practice

- 19.2.03P0 *Specific Objectives*  
By the end of the sub-module unit, the trainee should be able to:
- select quarrying method
  - sketch quarrying plant
  - select construction material content

- 19.2.04C *Competence*  
The trainee should have the ability to:
- select suitable tunnelling method based on rock type
  - provide appropriate safety measures during rock tunnelling

- 19.2.03P1 *Content*  
Quarrying method  
- mock blasting

- 19.2.03P2 Plant  
- sketches

- 19.2.03P3 Material selection

- 19.2.04T1 *Content*  
Purposes of rock tunnelling
- transportation
  - water and sewage
  - conveyance
  - mine access
  - hydro electric power generation

## 19.2.04 TUNNELS

### Theory

- 19.2.04T0 *Specific Objectives*  
By the end of the sub-module unit, the trainee should be able to:
- outline purposes of rock tunnelling
  - explain the influence of geology on machine tunnelling
  - outline geological problems that can be encountered when tunnelling
  - explain safety requirements when

- 19.2.04T2 Machine tunnelling
- weak zones
  - homogeneity
  - hardness
  - stratification

- 19.2.04T3 Geological problems
- high temperature
  - weak zones
  - dangerous gasses
  - over break

- 19.2.04T4 Tunnelling safety requirements



## Practice

19.2.04P0

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

- a) select protective wear for tunneling
- b) sketch plant for tunneling

### Content

Protective wear  
- gas masks  
Tunneling plant

19.2.04P1

19.2.04P2

19.2.05

## DAMS

### Theory

19.2.05T0

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

- a) outline purposes of dam construction
- b) explain factors to be considered when selecting a site
- c) outline geological problem associated with dams

19.2.05C

### Competence

The trainee should have the ability to:

- i) select a suitable site for dam construction based on geology of the area
- ii) identify appropriate measures that can

be taken if biological problems are encountered on a dam site

19.2.05T1

### Content

Purposes of dam construction

- hydro-electric power generation
- flood control
- irrigation
- water-supply

19.2.05T2

Geological factors for dam site selection

- stream narrowing
- permeability of site formations
- rock types of the site
- geological structures
- sedimentation of reservoir
- stability of reservoir slopes and floor

19.2.05T3

Associated geological problems

- leakage from reservoir
- reservoir siltation
- earth tremors

19.2.06

## MAPS

### Theory

19.2.06T0

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

- a) outline types of geological maps

|           |  |           |   |
|-----------|--|-----------|---|
|           | b) explain types of strata   |           |   |
| 19.2.06C  | <i>Competence</i><br>The trainee should have the ability to:<br>i) draw geological maps<br>interpret geological maps                                       | 19.2.06P1 | <i>Content</i><br>Drawing<br>- section  |
|           |  | 19.2.06P2 | Interpretation<br>- angle of dip strike for various strata<br>- three point method                              |
|           |  |           | <i>Suggested Teaching Learning Methods</i><br>- Lecture<br>- Group work   |
| 19.2.06T1 | <i>Content</i><br>Types<br>- solid<br>- drift  |           | <i>Suggested Teaching Learning Resources</i><br>- Charts<br>- Text books<br>- Internet services<br>- Calculator |
| 19.2.06T2 | Features<br>- scale<br>- key   |           |   |
| 19.2.06T3 | Types of strata  |           |   |
| 19.2.06T4 | Undeformed<br>- folded beds<br>- outcrops<br>- deformed strata   |           | <i>Suggested Assessment Methods</i><br>- Written tests<br>- Oral tests<br>- Assignment                          |
|           | <b>Practice</b>  |           |   |
| 19.2.06P0 | <i>Specific Objectives</i><br>By the end of the sub-module unit, the trainee should be able to:<br>a) draw geological maps<br>b) interpret geological maps |           | <b>Tools and Equipment</b><br>- Computer<br>- Excavation plant<br>- Hand/machine drills                         |