# The Open University of Sri Lanka
# Faculty of Engineering Technology
# Department of Civil Engineering

| | |
|---|---|
| Study Programme | : Bachelor of Technology Honours in Engineering |
| Name of the Examination | : Final Examination |
| **Course Code and Title** | **: CVX4344 Engineering Geology** |
| Academic Year | : 2020/21 |
| Date | : 02nd October 2020 |
| Time | : 0930-1230 hrs |
| Duration | : **3 hours** |

**General Instructions**

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **Eight (8)** questions in Five **(5)** pages.
3. Answer any **Five (5)** questions only. All questions carry equal marks. If you have answered more than five questions (either partly or in full), cross out the answers. Otherwise only the first five appearing in the answer book will be evaluated.
4. Answer for each question should commence from a new page.
5. Relevant charts/ codes are provided.
6. This is a Closed Book Test (CBT).
7. Answers should be in clear hand writing.
8. Do not use Red colour pen.

**Question 01**

The Earth on which we are living is located in the galaxy called 'Milky Way'.

i. *Describe* the composition of the galaxy called 'Milky Way'.

(05 marks)

ii. *State* the different theories that have been put forward for explaining the origin of the earth and *briefly discuss* the latest and most convincing theory.

(05 marks)

iii. With the use of neat illustration, *show* the three different parts (layers) of the earth and *describe* the composition of the interior of thesame.

(05 marks)

iv. *Briefly describe* **two (02)** different methods that have been used for determining the age of the Earth.

(05 marks)

**Question 02**

Igneous, sedimentary and metamorphic are the three broad rock groups that are distinguished on the basis of their origin that make up the greater part of the relatively thin outer shell, or crust, of the Earth.

i. *State* and *describe* **five (05)** different types of rock textures that can be identified in igneous rocks.

(05 marks)

ii. Explain how clastic sedimentary rocks are formed giving **four (04)** examples of the same.

(04 marks)

iii. *Briefly describe* the different types textures encounter in metamorphic rocks and their relationship with the type of metamorphism.

(06 marks)

iv. *Give an account* of how clay minerals are classified and uses of the same.

(05 marks)

**Question 03**

Streams are one of the most effective surface agents that erode rocks and soil.

i. *Explain* the processes in which rivers erode their beds.
(04 marks)

ii. *Describe* the different factors that give rise to stream bed erosion.
(04 marks)

iii. Different types of drainage patterns exist due to different types of geological materials through which the streams flow.
a) *Describe* **three (03)** different types of drainage patterns with illustrations. (03 marks)
b) *State* the geological characteristics of each drainage pattern. (03 marks)

iv. *State* **four (04)** counter measures that can be adopted against surface erosion.
(04 marks)

v. *List* **four (04)** depositional landforms developed by rivers.
(02 marks)

**Question 04**

The rock surface of the continents of the Earth, on which we live, is undergoing denundation due to weathering, erosion and transportation mechanisms.

i. *Define* the following terms with respect to weathering:
a) Exfoliation (02 marks)
b) Spherical weathering (02 marks)
c) Talus and Screes (02 marks)

ii. *Explain* briefly the factors that you would expect to influence the formation of the following landforms:
a) Formation of Horton Plains (03 marks)
b) Diyathalawa water falls in Central Highlands (03 marks)
c) Formation of Sigiriya (03 marks)

iii. *List* depositional and erosional landforms in the coastal areas of Sri Lanka separately and illustrate the same on a neat diagram.
(05 marks)

**Question 05**

The rocks of the Earth crust are generally unstable and are subjected to a number of forces operating within the Earth's body. Due to these forces, rocks may undergo deformation that results in different structural features such as, folds, faults, joints etc.

i. *Describe* with neat sketches the various types of folds encountered in the crust of the earth.
(05 marks)

ii. *Classify and describe* the different types of joints in a rock.
(05 marks)

iii. *Explain* how the presence of folds in the underlying rocks affects the stability of a dam.
(05 marks)

iv. *Distinguish* between the angular unconformity and disconformity using suitable sketches.
(05 marks)

**Question 06**

Aquifers in geological terms are referred to as bodies of saturated rocks or geological formations through which volumes of water find their way into wells and springs.

i. *Differentiate* between artesian and non-artesian aquifers, clearly bringing out the geological requirements essential for the development of artesian conditions.
(04 marks)

ii. *Describe* the South Western Laterite (Cabook) aquifer in Sri Lanka.
(04 marks)

iii. *Explain* the aquifer potential of sedimentary rocks in relation to the different admixtures and cementing materials that is observable in sedimentary rocks.
(04 marks)

iv. *Write an account* of erosive work of groundwater in regions underlying soluble lime stones describing the different features of karst topography.
(04 marks)

v. A limestone formation is having a coefficient of permeability (k) of $4 \times 10^{-2}$m/day. If the particular rock is having an aquifer of saturated thickness 15m, *determine* the transmissibility of the aquifer.
(04 marks)

## Question 07

Geophysical surveys and investigations find extensive use in a number of problems concerning civil engineering uses of geological and non geological details.

i. *Derive* the formula to determine the subsurface strata thickness of a two-layer case (with a horizontal interface) using the seismic refraction method, *stating* the assumptions used in deriving the same.

(06 marks)

ii. In a two-layer case of refraction technique of seismic wave method of geophysical subsurface exploration, six geophones were placed along a straight line representing the axis of a proposed dam at distances 400m, 600m, 600m, 1200m, 1600m and 2000m from the shot point. The observed seismic record is given in Table 1. *Determine* the depth of bed rock (second layer).

(06 marks)

**Table 1**

| Distance from the shot point (m) | Time of first arrival (sec x$10^{-3}$) |
|---|---|
| 400 | 200 |
| 600 | 300 |
| 800 | 400 |
| 1200 | 500 |
| 1600 | 600 |
| 2000 | 700 |

iii. It is necessary to locate an old river path. *Describe* a suitable shot and geophone arrangement for this purpose using an illustration.

(05 marks)

iv. Electrical prospective methods are classified into **five (05)** groups. *State* these methods.

(03 marks)

## Question 08

i. *State* the primary objectives of a site investigation programme.

(04 marks)

ii. *List* **four (04)** factors that decide the depth of exploration of the ground for construction purposes.

(04 marks)

iii. *Describe* how the Plate load test is carried out, *explaining* its purpose in construction work.

(04 marks)

iv. The degree of disturbance for a soil sample is usually expressed using the parameter 'Area Ratio'.

a) *State* the equation that is used to calculate the 'Area Ratio'.

(02 marks)

b) *Compare* the area ratios and degree of disturbance of Split Spoon diameter havingoutside diameter = 50.8mm & internal diameter = 34.9mm with Shelby Tube having76.2mm outer diameter & wall thickness 1.55mm.

(02 marks)

v. *Describe* a suitable sampling method that can be used for sampling soft cohesive soils.

(04 marks)