



THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

Department of Civil Engineering

SECOND SEMESTER EXAMINATION - 2022

Second Year Bachelor of Civil Engineering (Honours)

Subject Code: **CE221**

Subject Name: **Soil Mechanics and Geology**

Date: **4th November, 2022**

Time: **8:30 am to 11:30 am**

Venue: **C004/005**

Examination Instructions

1. **NO MOBILE PHONE** is allowed in the examination room.
2. You have 10 minutes to read the paper.
3. Fill-in your details in the answer slip. **DO IT NOW.**
4. **There are 8 questions. Answer ONLY 5 Questions.**
5. Write your answer in the answer booklet provided.
6. Do not consult your notes. Students caught cheating will be removed from the examination room and will get a zero mark for the examination.

Question 1

- a) What is plate tectonic? Please explain how plates interact with each other. (3 marks)
- b) There are three types of rocks, name each type and explain the processes by which they are formed? (3 marks)
- c) Define the following terms;
 - (i) Geologic process
 - (ii) Oceanic process
 - (iii) Geotectonic (3 marks)
- d) State three importance of geology in civil engineering. (3 marks)
- e) List eight physical properties of minerals. (5 marks)
- f) Alluvium is a general term used for what kind of deposits? Explain. (3 marks)

Question 2

- (a) Briefly discuss three groups of soils based on the modes in which they were formed? (5 marks)
- (b) Define the following terms in soil mechanics usage;
 - (i) Plasticity index
 - (ii) Liquidity index
 - (iii) Activity of a soil (5 marks)
- (c) With the assistance of a sketch, identify and define the Atterberg limits? (10 marks)

Question 3

- (a) Describe briefly how you would identify the following soils in the field by visual examination, and touch.
 - (i) Gravel and sand
 - (ii) Silts
 - (iii) Clay
 - (iv) Organic soils (8 marks)

- (b) Two soils (Soil A and Soil B) are mixed together in the proportion of 2kg of Soil A to each kg of Soil B. The grading for each soil is shown in Table Q3b. Determine the Particle Size Distribution of the resulting soil mixture and classify it according to the Unified Soil Classification System.

Table Q3b

Percentage passing sieve size	Soil A	Soil B
2.36 mm	100	91
1.18 mm	95	80
0.60 mm	62	62
0.30 mm	26	48
0.15 mm	8	20

(12 marks)

Question 5

A compacted cylindrical soil specimen, 50 mm in diameter and 100 mm long is to be prepared from an oven dry soil by the addition of water. The prepared specimen is to have a water content of 15% and an air content of 17%. If the specific gravity of the soil is 2.68, determine:

- The mass of soil and the volume of water required in the preparation of the specimen. (5 marks)
- The bulk unit weight and the air voids content of the compacted specimen. (5 marks)
- The void ratio, porosity and the degree of saturation of the compacted specimen. (10 marks)

The unit weight of water may be taken as 9.81 kN/m^3 .

Question 6

- Briefly describe the California Bearing Ratio (CBR) test stating why annular rings are placed on the test samples when loaded.
- Briefly describe what the soaked and unsoaked CBR values are meant to represent for the in-situ soil condition?

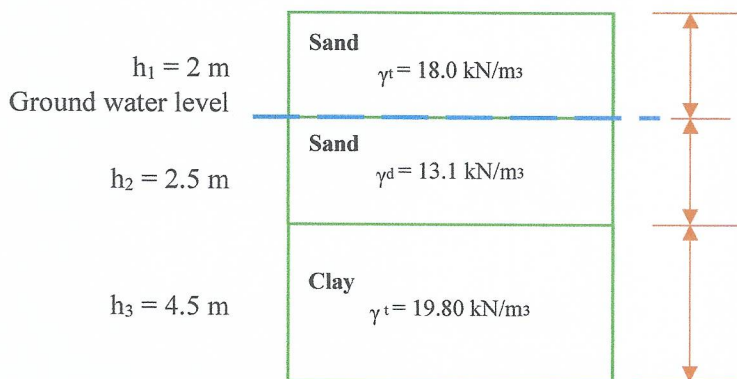
(10 marks each = 20 marks)

Question 7

- (a) Define the following terms in soil permeability and flow of water in soil;
- (i) Aeration zone
 - (ii) Saturation zone
- (b) How do you derive the hydrostatic head for the flow of water in soil or seepage problem? (6 marks)
- (c) How do you determine the coefficient of permeability? (10 marks)

Question 8

Calculate the total stress, pore water pressure and effective stress for the following layers of soil;



(20 marks)

END OF EXAMINATION