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**UTHM**  
Universiti Tun Hussein Onn Malaysia

**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER II  
SESSION 2021/2022**

COURSE NAME : SOIL MECHANICS  
COURSE CODE : BPD 14402  
PROGRAMME CODE : BPC  
EXAMINATION DATE : JULY 2022  
DURATION : 2 HOURS  
INSTRUCTION : 1. ANSWER ALL QUESTIONS  
2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK**.  
3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF SEVEN (7) PAGES

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- Q1** Shear strength of a material is the load per unit area that it can withstand before undergoing shearing failure.
- (a) Explain **FIVE (5)** conditions requiring shear strength assessment. (10 marks)
- (b) Discuss with examples **TWO (2)** types of cohesive strength. (15 marks)
- Q2** Soils are stable if the stress level is maintained or water content remains constant. However, when the stress applied to the soil mass has increased, it deforms and causes settlement.
- (a) Define:
- (i) Settlement.
- (ii) Consolidation. (5 marks)
- (b) Differentiate between Casagrande Method and Taylor Method using sample information as in **Appendix I, Figure Q2(b)(i)** in **Appendix II** and **Figure Q2(b)(ii)** in **Appendix III**. (20 marks)
- Q3** Soil sieving can be performed in either wet or dry condition.
- (a) Describe the smallest and largest mesh openings to determine grain size distribution. (4 marks)
- (b) Describe the methodology to carry out a sieve analysis on a sample of clay. (7 marks)
- (c) Discuss with examples the conditions of the soil whether to use wet sieving or dry sieving. (14 marks)

**Q4** Disturbed and undisturbed samples are collected through many sampling methods including test pits, thin walled sampler, Mazier sampler, soil penetration test, and cone penetration test.

Differentiate the process of the above mentioned methods.

(25 marks)

**- END OF QUESTIONS -**

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**Sample information:**

Sample no: 1A  
Location: Batu Pahat, Johor, Malaysia  
Coordinate: 1.8500° N, 102.9300° E  
Depth: 5 meter  
Type of soil: Clay  
Unit weight: 18 kN/m<sup>3</sup>

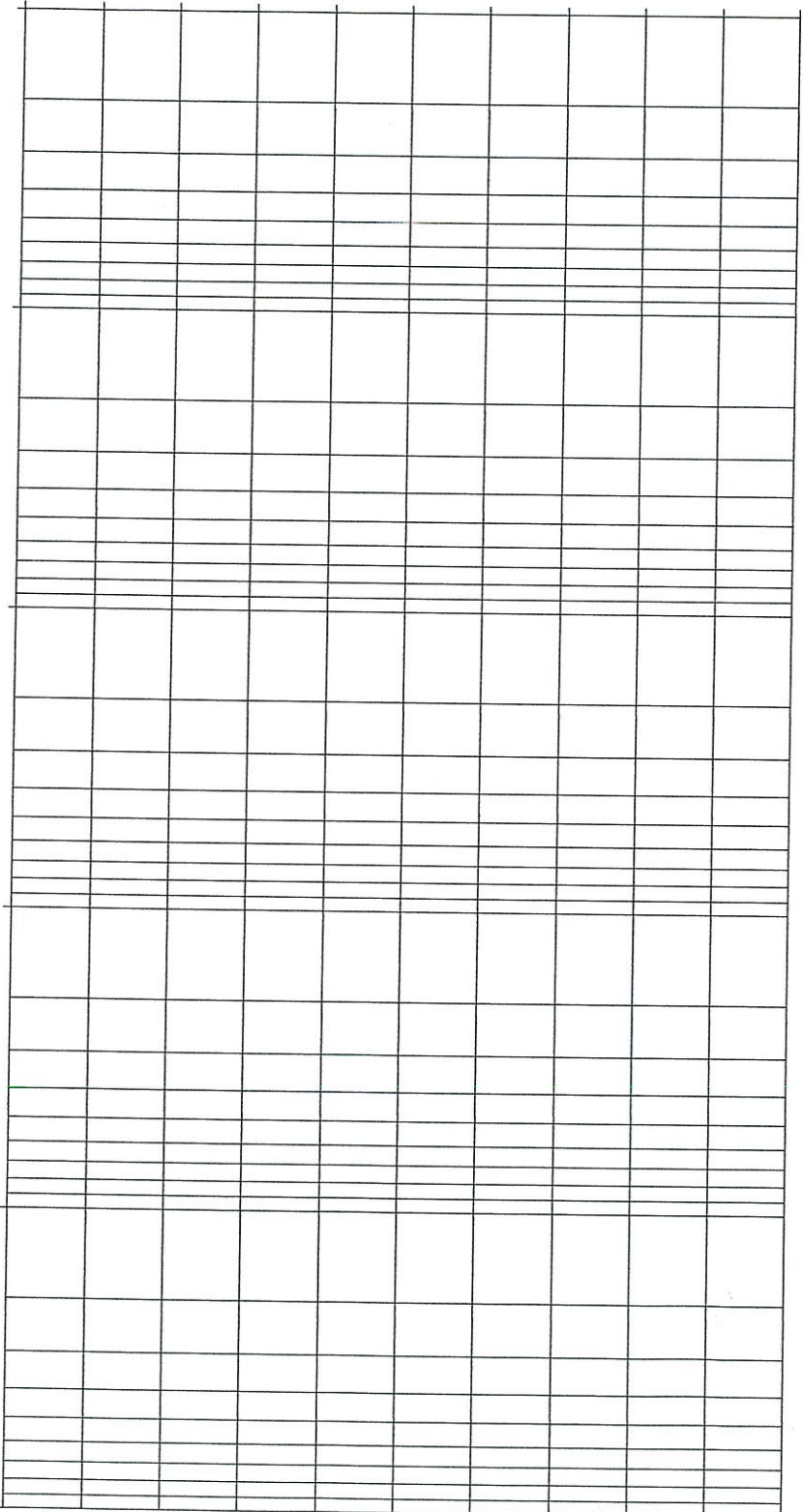
**Table Q2(b) Oedometer test result**

<b>Effective stress (kN/m<sup>2</sup>)</b>	25	50	100	200	400	800	200	50
<b>Void ratio (e)</b>	0.85	0.82	0.71	0.57	0.43	0.3	0.4	0.5

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A large empty grid consisting of 20 columns and 10 rows, intended for drawing or calculation.

Figure Q2(b)(i)

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**Equation for  $m_v$ :**

$$m_v = \frac{\Delta e}{\Delta \sigma'} \frac{1}{1+e_{avg}}$$

Where, 
$$e_{avg} = \frac{e_1 + e_2}{2}$$

$$\text{Gradient of the curve} = \frac{\Delta e}{\Delta \sigma'}$$

Therefore,  $m_v = \text{Gradient of the curve} \times \left[ \frac{1}{1 + \left[ \frac{e_1 + e_2}{2} \right]} \right]$

**Equation for  $C_c$ :**

$$C_c = \frac{e_1 - e_2}{\sigma'_1 - \sigma'_2}$$

**Equation for  $\sigma'_o$ :**

$$\sigma'_o = \frac{(\gamma_{sat} - \gamma_w) H}{2}$$