First Semester Examination
2020/2021 Academic Session

February 2021

EAG345 – Geotechnical Analysis

Duration : 2 hours

Please check that this examination paper consists of **FIVE (5)** pages of printed material before you begin the examination.

Instructions : This paper contains **FOUR (4)** questions. Answer **ALL** questions.

All questions **MUST BE** answered on a new page.

1. **Figure 1** shows a rigid wall prevented from lateral movement.

(a). Determine the lateral thrust for the at-rest condition and the point of application of the resultant force.

[5 marks]

(b). Determine the active earth pressure distribution when the water table is at 3 m below the ground level.

[7 marks]

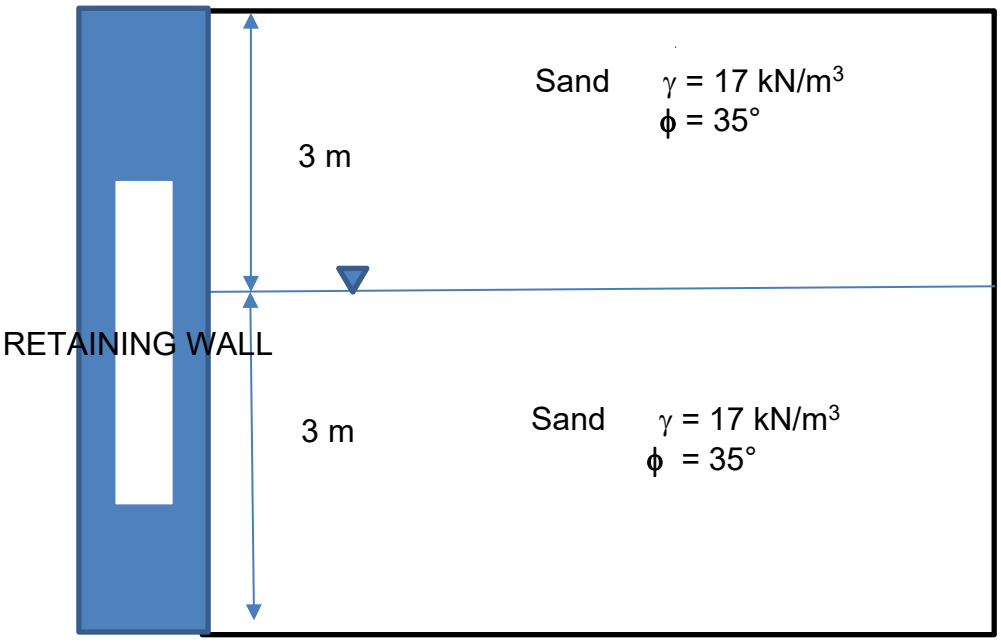

Figure 1

(c). Sketch L Shape wall with a full height of 8 m and calculate its stability accordingly. Make suitable assumption for other parameters.

[13 marks]

2. (a). Sketch and illustrate the slope failure, then explain why the slope fail.

[5 marks]

(b). Stability of slope can be analysed by various methods. Name **THREE (3)** available methods that you know and illustrate one of the methods by elaborating the required analysis to be carried out.

[10 marks]

(c). Analyse the slope shown in **Figure 2** using the most approprorite method.

[10 marks]

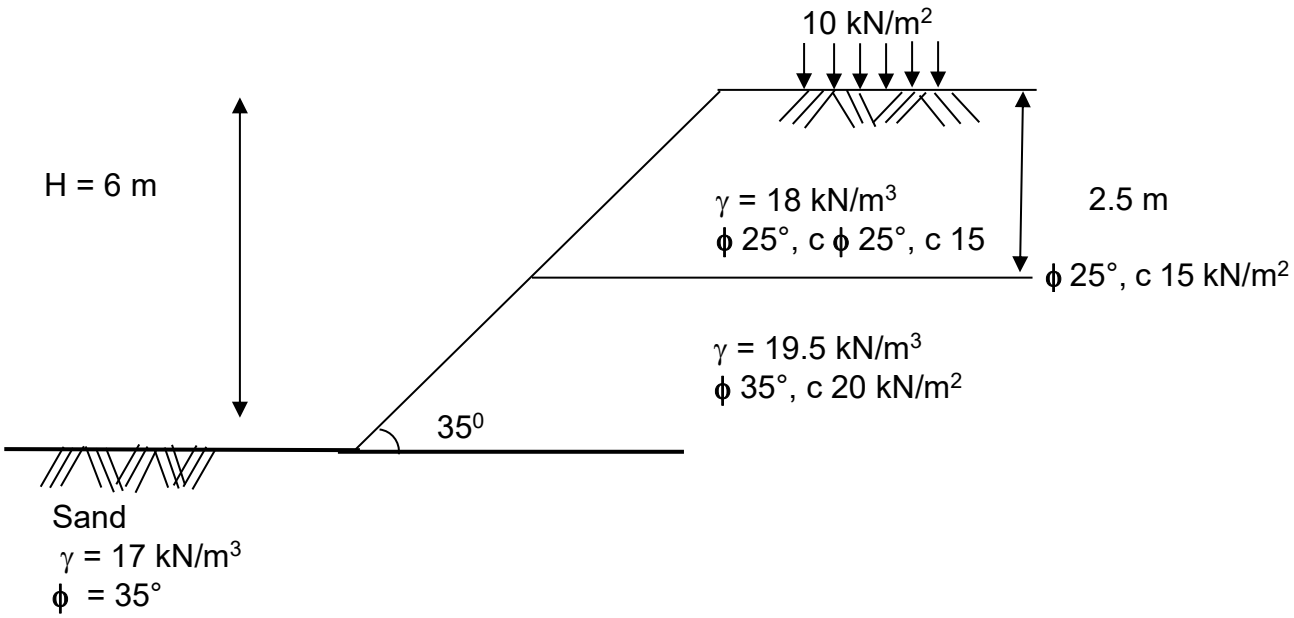

Figure 2

3. (a). The shear strength of a soil is its resistance to shearing stresses. Using relevant sketches, describe the typical behaviour of sand in term of shear strain against shear stress with increase of normal effective stresses. Relate this behaviour to shear stress vs normal stress relationship and the determination of Mohr-coulomb failure envelope.

[10 marks]

(b). Two CD triaxial tests are conducted on identical specimens of the same sand. Both specimens are initially consolidated hydrostatically to 50 kPa; then each specimen is loaded as shown in **Figure 3**. Specimen A failed when the applied $\Delta\sigma_1$ was 18*x* kPa (*x* is your final digit of examination index number). Determine the necessary calculations to:

(i). Plot the Mohr circles at failure for both tests

(ii). Determine ϕ' for the sand

[15 marks]

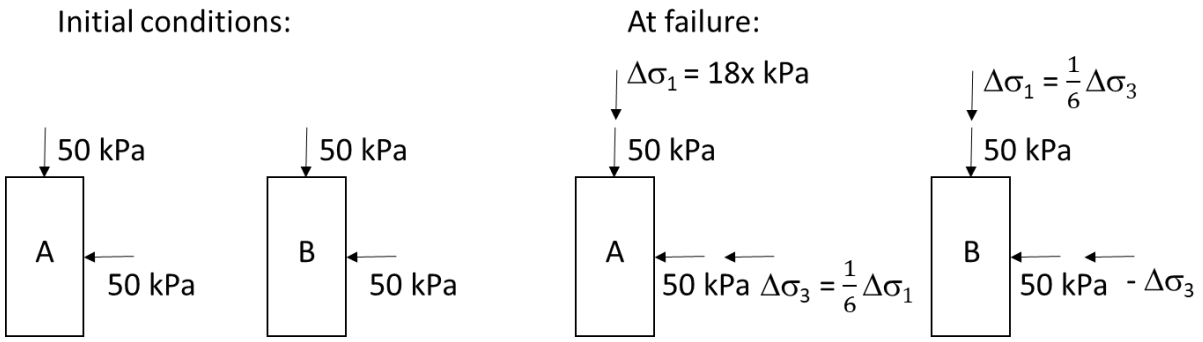

Figure 3

4. (a). Structural loads are transferred to the soil via the foundation. As an engineer, you are required to design a foundation for a particular structure. Describe the **TWO (2)** stability conditions that must be met and state the term for both conditions.

[5 marks]

(b). A concrete pile 405 mm x 405 mm in cross-section is shown in **Figure 4**.

Calculate:

(i). The ultimate point load, using Meyerhof's procedure

(ii). The ultimate frictional resistance, Q_s (Use K = 1.4 and $\delta = 0.6\phi'$) using α-method, λ-method and β-method. State the reference table (table number and page) used in your textbook

(iii). The allowable load of the pile (with FOS = 4)

(iv). Based on the pile's allowable load in (iii), determine the pile's maximum length if the pile changes to 300 mm x 300 mm

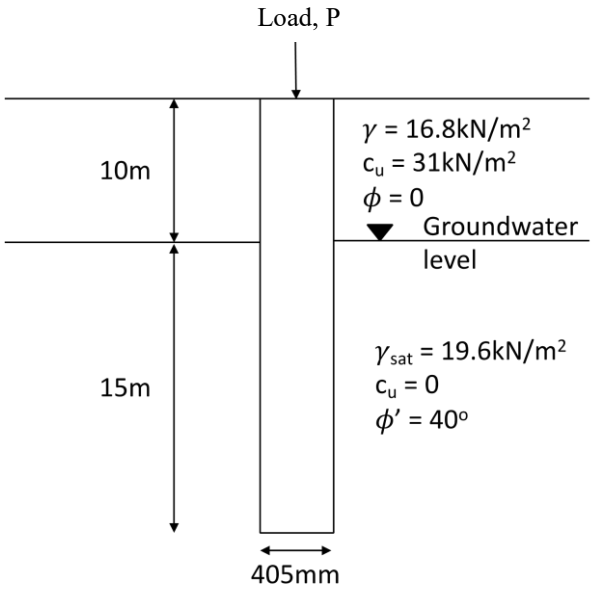

Figure 4

[20 marks]

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