一、 **Short questions (just write down your answers in one or two lines)**

1) 3%

What are the units of Liquid Limit and Plastic Limit?

2) 3%

Express the Mohr-Coulomb failure criteria in an equation.

3) 3%

What test do geotechnical engineers use to determine the optimal water content of soil?

4) 3%

What test do geotechnical engineers use to determine the permeability of soil?

5) 3%

What test do geotechnical engineers use to determine the coefficient of gradation (C_c) of soil?

6) 3%

What test do geotechnical engineers use to determine the undrained shear strength soil?

7) 3%

What test do geotechnical engineers use to determine the swelling index of soil?

8) 3%

In geotechnical engineering, effective stress is equal to what?

9) 3%

How to determine the soil's water content?

10) 3%

In geotechnical engineering, what soil properties can be determined with the direct shear test?

二、 **Long questions**

1)

a. 5%

Draw the test set-up of the constant head test and derive the governing formula to determine k.

b. 5%

The results of a constant-head for sand are as follows:

● Constant head difference = 500 mm
● Time for collecting water = 5 min
● Volume of water collected = 350 cm³

Given the soil sample having a diameter of 150 mm and length of 300 mm, fine the permeability of the sand.

2)

For a normally consolidated clay, the results from a triaxial "CD" test are as follows: confining pressure = 104 kPa, deviator stress at failure = 125 kPa

a) What does "CD" stand for? (2%)
b) What is the friction angle of the soil? (5%)
c) What is the angle between the failure plane and the major principal plane? (3%)

3)

今欲於某均質飽和黏土層(不排水剪力強度 C_u=45kPa，飽和單位重 $\gamma_{sat.}$=20 kN/m^3)中開挖斜坡，預計開挖垂直深度為 10 米，若考慮斜坡安全係數為 1.2，請計算可以開挖的最大斜面角度。(已知坡角為 53 度時，穩定數為 0.18；坡角為 90 度時，穩定數為 0.26，另假設坡角 53~90 度間之穩定數變化為線性。) (10%)

4)

於某乾砂土層(單位重為 18 kN/m^3)中進行標準貫入試驗，深度 1.5 米處之 N_{60} 值為 20，深度 8 米處之 N_{60} 為 25。請回答下列問題：

    (a) 請簡要說明何謂 N_{60} 以及 $(N_1)_{60}$。(10%)

    (b) 請以 $(N_1)_{60}$ 比較深度 1.5 米與深度 8 米處之砂土緊密程度。(10%)

5)

請寫出 Terzaghi's 長條形淺基礎之極限承載力公式，並說明各分項之物理意義。(5 分)；請寫出 Meyerhof's 通用淺基礎極限承載力公式，並說明各修正因子的意義。(5 分)

6)

請寫出 Rankine 與 Coulomb 土壓力理論假設與可考量條件之差異。(10 分)