

國立成功大學

111學年度碩士班招生考試試題

編 號： 99

系 所： 土木工程學系

科 目： 土壤力學

日 期： 0219

節 次： 第 2 節

備 註： 可使用計算機

※ 考生請注意：本試題可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

一、 Briefly answer the following questions (簡答題) (30 pts, 6 pts/each):

1. Describe how to differentiate SM and SC soils in USCS for sandy soils with fines.
2. List three major contributions by Arthur Casagrande in the geotechnical field.
3. List the similarities and differences between "compaction" and "consolidation".
4. Describe how to use the fall cone method (BS 1377-1990) to determine the liquid and plastic limits of fine-grained soils.
5. List the major factors affecting the soil compaction curve.

二、 Answer the following questions about seepage. (25 pts)

1. Describe the falling head permeability test and derive the equation for the calculation of soil permeability. (10 pts)
2. Use the flow net and dimensions of the weir in Fig. 1 to calculate (1) the flow rate per meter thickness with isotropic permeability $k=3 \times 10^{-3}$ cm/sec, (2) the pressure head distribution at the bottom of the weir, and (3) the uplift force applied to the weir. (15 pts)

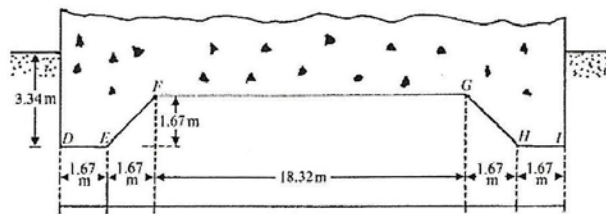
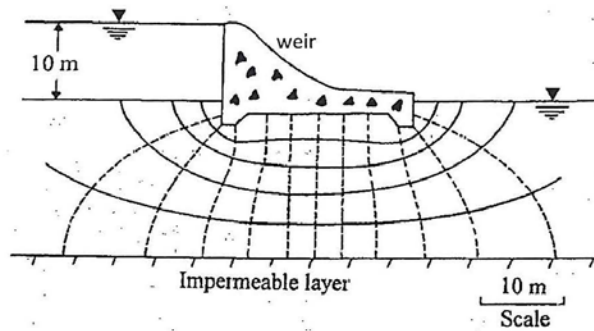


Fig. 1

三、 Answer the following questions for the soil stratum in Fig. 2. (20 pts)

1. Given $H_1=2.2$ m, $H_2=4.4$ m, $H_3=7.4$ m, $\Delta\sigma=105$ kPa, and the clay layer is normally consolidated before the application of the surcharge. Compute the primary consolidation induced by the surcharge. (10 pts)
2. If the clay sample with a thickness of 2.5 cm achieves a 90% average degree of consolidation in 26.5 minutes, compute the time for the clay layer in Fig. 2 to achieve the same average degree of consolidation in the field. (5 pts)
3. If the GWT lowers 2 m after the completion of primary consolidation by the surcharge, compute the ground subsidence due to the GWT variation. (5 pts)

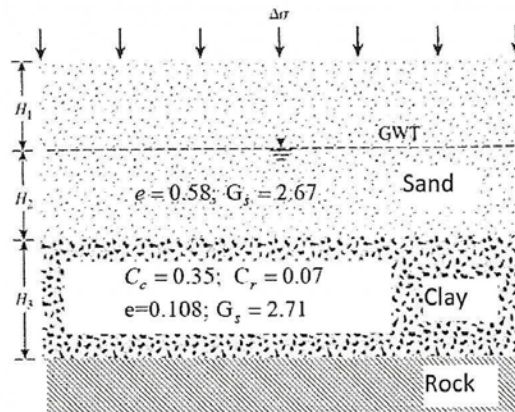


Fig. 2

四、Answer the following questions related to the shear strength of soils: (25 pts)

1. Given the conditions for an SCU triaxial test of NC clay: effective consolidation pressure $\sigma'_3 = 100$ kPa, Skempton's pore pressure parameter at failure $\bar{A}_f = 0.5$, and $\phi' = 30^\circ$. Predict the deviatoric stress at failure. (10 pts)
2. For the same test, plot the total and effective stress paths with the lines of stress ratio at failure (K_f -line). (10 pts)
3. Use the undrained shear strength ratio from the SCU data to estimate the undrained shear strength of the same clay layer at the effective overburden pressure of 75 kPa with $OCR=2$. (5 pts)