編號： 98

國立成功大學 109 學年度碩士班招生考試試題

系　　所：土木工程學系

考試科目：土壤力學

考試日期：0210，節次：2

※ 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。

Make rational assumptions if needed.

一、簡答題 (20 pts):

1. Define the Atterberg limits of fine-grained soils and describe the stress-strain diagrams at various states. (5 pts)
2. Describe the falling head tests and derive the equation for measuring the hydraulic conductivity. (5 pts)
3. Describe the Casagrande logarithmic method for determination the consolidation coefficient from Oedometer tests. (5 pts)
4. Compare the similarity and differences between "compaction" and "consolidation". (5 pts)

二、Refer to Fig. 1 and answer the following questions related to consolidation: (25 pts)

1. Given H_1=2.2 m, H_2=4.4 m, and H_3=7.4m, plot the vertical total stress, vertical effective stress, and pore pressure profiles from surface to 14.0 m deep **without surcharge**. (10 pts)
2. Given $\Delta\sigma$=105 kPa, calculate the primary consolidation settlement for soil stratum shown in Fig. 1. (10 pts)
3. How long will it take in the field to achieve average consolidation of 80% (Given U_{avg}=0.85, T=0.567)? (5 pts)

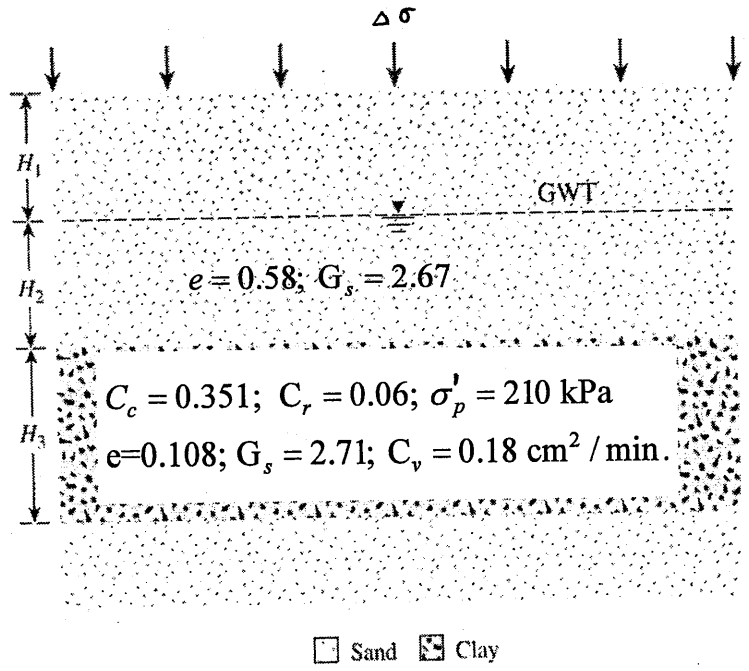

Fig. 1

三、Answer the following questions related to shear strength of soils: (30 pts):

1. A NC clay sample is subjected to SCD testing with an effective consolidation stress of 100 kPa. Plot the Mohr circle at failure, mark the pole, and find the failure plane for $\phi' = 30^\circ$. (10 pts)
2. Find the total and effective strength parameters and plot the total and effective stress paths for the

following conditions:

SCU on loose sand, $\sigma_3' = 100$, $\Delta\sigma_{d,f} = 125$, $\Delta u_f = 75$ (unit: kPa). (15 pts)

3. In MIT stress path method, the K_f-line is expressed as $q = m + p' \tan\alpha$, express (m, α) with Mohr-Coulomb strength parameters (c', ϕ'). (5 pts)

四、Answer the following questions related to seepage: (25 pts):

1. Derive the governing equation for 2D steady state flow and list the assumptions during the derivation process. (10 pts)
2. Calculate the flow rate of Fig. 2 in m^3/sec/m and plot the flow net. (10 pts)
3. Calculate the flow rate in Fig. 2 in m^3/sec/m with anisotropic permeability k_v=0.075 cm/sec and $k_H / k_V = 4$. (5 pts)

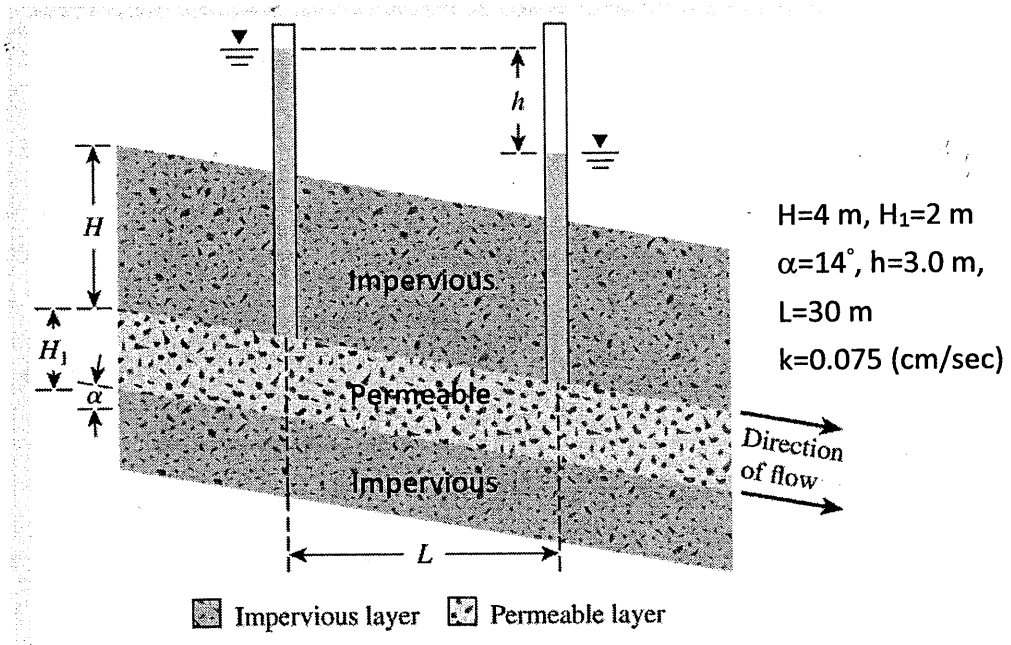

Fig. 2