

# 國立交通大學 103 學年度第 2 學期 博士班資格考筆試考試試題

土木工程學系 大地組(丁)

科目：土壤力學

選考學生數：1

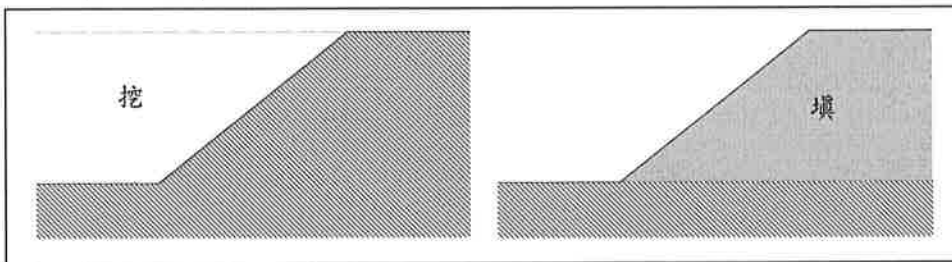
考試時間：180min

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## (Part I: Close Book)

1. 請說明何謂共振柱試驗(resonant column test)? 其控制方程式(wave equation)為何? 請簡單繪圖說明共振柱試驗的流程圖。就你所知，共振柱試驗可以分為哪幾種類型? 共振柱試驗可以求出那些動態土壤參數?(10%)
2. (a) 請說明為何在受到地震力作用後，擋土結構物可能逐漸產生側向位移。  
(b) 為何濱水擋土結構物(waterfront retaining structures)在地震後，常發生重大損壞?(10%)
3. 現場的土壤為黏土。試比較開挖與填土，以繪圖方式表示在現地的黏土中：  
(a)總應力隨時間之變化；(b)孔隙水壓隨時間之變化(假設初始狀況為接近飽和)；(c)有效應力隨時間之變化；(d)不排水剪力強度的變化。並說明現場開挖與填方形成的邊坡，在穩定性方面，短期與長期邊坡穩定間之比較。並針對上述的這些關係，說明其原因。(10%)

註：黏土的狀態、各種強度的概略範圍等因素，請自行假設。



4. Answer the following questions: (10%)

(a) Explain why the values of  $\frac{\tau_f}{\sigma_{vc}}$  of normally consolidated clay are different for undrained shear strength obtained from triaxial compression and triaxial extension tests?

(b) How and why  $\frac{\tau_f}{\sigma_{vc}}$  of over consolidated clays be different from normally consolidated clays?

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(c) What are the relationships between shear strength obtained from CD and CU tests? State your reasons.

	Normally consolidated clay	Overconsolidated clay
Triaxial compression ( $\sigma_3$ constant, $\sigma_1$ increasing)	e.g. CD > CU?	
Triaxial compression ( $\sigma_1$ constant, $\sigma_3$ decreasing)		

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## (Part II: Open Book)

5. “Exit gradient” is a key parameter in the seepage analysis against piping in soil. What is exit gradient? How do we determine the exit gradient? Why “exit” gradient is more important than any other gradient in the soil mass? To assure safety of a hydraulic structure such as an earth dam, we normally require the exit gradient to be less than a certain value. What would you recommend this required value to be? If the analysis shows that the exit gradient for an earth dam is too high, what kind of corrective measures that you can recommend?  
(20%)
6. The Terzaghi’s one-dimensional consolidation theory models the time-dependent compression in a clayey soil layer. List all the assumptions made in this theory. Comment on the possible violation of those assumptions if the classical theory is applied to predict the in-situ settlement under the following scenarios: (1) de-watering using point wells around a deep excavation site, and (2) soil improvement using prefabricated vertical drains or sand drains with preloading. Also, discuss the possible sources of uncertainties for the prediction of ground settlement under the second scenario.  
(20%)
7. (a) To describe a soil as a three-phase material, what are the important “intrinsic” parameters and “state” parameters? (b) Please comment on the current practice for measuring these parameters. (c) In your opinion, can these important intrinsic and state parameters be measured based on some physical properties in a more scientific fashion? What researches should be done to achieve this goal? (20%)