國立成功大學

113學年度碩士班招生考試試題

編　　號：97

系　　所：土木工程學系

科　　目：土壤力學

日　　期：0201

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。

Note: Make rational assumptions if necessary.

一、Answer the following questions (簡答題) :

1. List the 3 major clay minerals and their possible group symbols in USCS classification. (15 pts)

2. Compare the 3 major engineering properties of the granular and cohesive soils. (10 pts)

二、Use Bernoulli's equation, pressure heads, and effective stress principle to derive the following expressions for a saturated soil column:

1. Derive the increment of effective vertical stress $(\Delta\sigma_v')$ for an upward seepage condition subjected to a constant hydraulic gradient (i) using the following symbols: (1) at the elevation of z (positive z in the upward direction), the vertical stress, total head, and pore water pressure are σ_V, h, and u, respectively; (2) at the elevation of (z-Δz), the vertical stress, total head, and pore water pressure are $(\sigma_v + \Delta\sigma_v)$, (h+$\Delta$h), and (u+$\Delta$u), respectively. (15 pts)

2. Based on the expression of the vertical effective stress of the upward seepage condition and the definition of quicksand, derive the critical hydraulic gradient. (10 pts)

三、Answer the following questions related to the compressibility of soils.

1. List the major factors that shall be considered in calculating the elastic settlement of a foundation subjected to a vertical load. (5 pts)

2. Given a clay layer with the following initial conditions: vertical effective stress=σ_{v0}', compression index=C_c, swelling index=C_r, OCR=2, void ratio=e_0, and layer thickness=H. Predict the consolidation settlement when the final vertical effective stress is three times the initial vertical effective stress. (15 pts)

3. Explain the purpose and theory of sand drains in consolidated layers. (5 pts)

四、Answer the following questions about in-situ stress and shear strength.

1. Define the Skempton (1954) pore pressure parameters and the range of values at failure. (10 pts)

2. Following the empirical correlation by Ladd et al. (1977), estimate the undrained shear strength (S_u) of a saturated, non-plastic silty clay with OCR=3 and effective overburden stress of 100 kPa. (For NC clay, Skempton (1957): $S_u/\sigma_v' = 0.11+0.0037(PI)$). (10 pts)

3. Express the strength parameters (m, α) of the stress path by Lambe (1964) in terms of (c, ϕ) in Mohr-Coulomb failure criteria. (5 pts)