

八十七學年度第一學期博士學位候選人資格考試時間表

時間	考試科目
8:30 10:10	土壤力學 (CLOSE BOOK) 路面材料 (CLOSE BOOK)
10:20 12:00	基礎工程 (CLOSE BOOK) 結構動力學 (CLOSE BOOK) 鋪面工程 (OPEN BOOK)
14:30 16:10	有限元素法 (CLOSE BOOK)

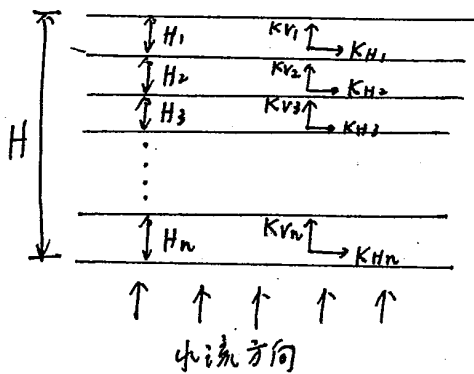
- 考試日期：87年10月27日(星期二)
- 地點：土木系大會議室
- 考試時請攜帶學生證。

大地組 博士資格考試 (土壤力學) 試題 (1998, 10, 27)

1. 何謂 ① 壓密 ② 最大乾密度 ③ 有效粒徑 ④ 改良普羅克達試驗 ⑤ CU Test
 ⑥ 相對密度 ⑦ N 值 ⑧ 統一土壤分類法 ⑨ 主動土壓力 ⑩ 被動土壓力
 (30%)

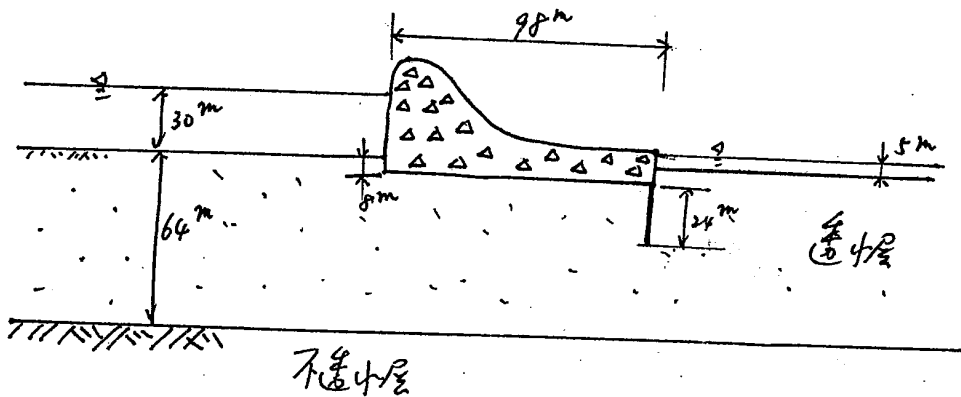
2. 試證
$$\gamma_d = \frac{e S \gamma_w}{(1+e) \gamma}$$
 (5%)

3. 有一層狀土壤如下圖所示: (15%)



其中 H_1, H_2, \dots, H_n 為各層之厚度, $K_{V_1}, K_{V_2}, \dots, K_{V_n}$ 為各層之垂直方向之滲透係數。
 請向此層狀土壤之等效滲透係數 $K_{V(eq)}$ 為何?

4. 有一水渠如下圖所示, 請繪流線圖。 (20%)



5. 請解釋下列名詞 (20%)

- (1) 壓力路徑 (stress path)
- (2) Skempton 之孔隙水壓力參數 A, B.
- (3) 壓縮指數 (compression index)
- (4) OCR

6. Terzaghi (1925) 提出飽和粉土層單向壓密理論, 該理論之推導是基於何種假設而得? (10%)

路面材料 (每題 20 分)

- 1 現行瀝青規範如何限制瀝青之溫感性(Temperature Susceptibility)?
- 2 瀝青規範中之不同試驗，其中不同之試驗溫度所代表的實際意義為何？
- 3 SHRP 之瀝青規範中，如何選用適當等級之瀝青？
- 4 夯壓程度對配合設計之決定最佳含油量有何影響？
- 5 SHRP 之瀝青規範如何確保鋪面成效？

國立成功大學土木工程學研究所博士班資格考試基礎工程試題

October, 1998

考試方式:CLOSE BOOK

考試時間:1小時40分鐘

及格標準:70分

- 一、(1)在何種情況採用聯合基腳(combined footing foundation)? 試舉兩種情形申論之。(10%)

(2)試述聯合基腳基礎之設計程序及應考慮之事項。(10%)

- 二、試詳述決定基礎形式的因素。(15%)

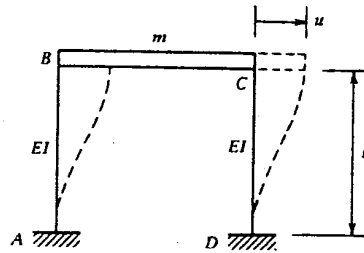
- 三、某懸臂鋼板樁擋土牆(cantilever sheet pile)，將擊入內摩擦角， $\phi = 30^\circ$ 及單位重 $\gamma = 16.8 \text{ kN/m}^3$ 之土層，以承受高為 5.5m 之土壤壓力(土壤之內摩擦角及單位重和土層相同)。試求樁土系統之安全係數達到 1 時，鋼板樁貫入土層之深度。並繪出作用於鋼板樁上之淨土壓力分佈(net earth pressure distribution)。(25%)

- 四、德在基(Terzaghi)在發展其基礎承載力理論(bearing capacity theory)時，作了一些假設。這些假設，在進行基礎承載力分析時，可作為工程研判之參考，請敘述這些假設。(20%)

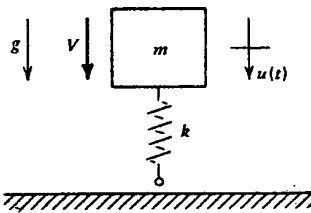
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STRUCTURAL DYNAMICS (CLOSED BOOKS AND NOTES)

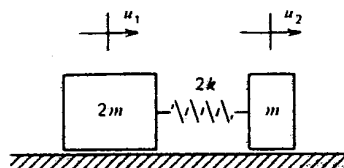
1. A frame structure shown below consists of a rigid horizontal member BC of mass m supported by two vertical members each of whose bending stiffness is EI . Neglect the effect of the weight of BC on the stiffness of the vertical members. Determine the equation of motion. (25%)



2. A single degree of freedom system has an undamped natural frequency of 5 rad/s and a damping factor of 20%. It is given the zero initial displacement while the initial velocity is 20 in./sec. Determine the damped natural frequency, and determine the expression for the system for $t > 0$. (25%)
3. A simplified model is to be used to study landing impact of a light aircraft. The landing is modeled as a lumped mass with a linear spring representing the landing gear. (see the Fig. below) The mass m has a vertical descent speed of V when the spring touches the ground. Call the time of contact $t = 0$, and let $u(0) = 0$.
- Determine an expression for the vertical position of the mass as a function of time during the time that the spring remains in contact with the ground.
 - Determine the time at which the spring loses contact with the ground upon rebound. (25%)



4. (a) Determine the equations of motion of the system shown below.
 (b) Determine the natural frequencies and mode shapes of this system. (25%)



國立成功大學土木工程研究所 87 學年度博士班資格考試
鋪面工程試題

1. 請說明
 - a. Present Serviceability Index (PSI)與 Present Serviceability Rating (PSR)之關係 (10%)
 - b. PSI 與 Pavement Condition Index (PCI)之差異 (10%)
2. 鋪面管理系統
 - a. 請簡要列出一個完整的鋪面管理系統應該包含哪些子系統？ (10%)
 - b. 輔助決策模式是鋪面管理系統的重要子系統，可以根據資料庫中各路段的資料與預測，提供維修建議。請問常見的決策模式包括哪幾種，並請簡要說明。(10%)
3. 鋪面材料
 - a. Resilient Modulus (Mr)與 Modulus of Elasticity (E)之定義有何不同？ (10%)
 - b. 他們分別適用於哪些材料？為什麼？ (5%)
 - c. 如果您不方便直接進行 Mr 值之試驗，請問您有什麼方法得知 Mr 值？在使用您提的方法時，應注意什麼？ (10%)
4. 鋪面設計
 - a. 請依照下列已知條件，以 AASHTO 規範設計剛性路面厚度
CBR of subgrade soil = 5
Design ESAL = 12000000
Load transfer = aggregate interlock
Base course = 10 inch of granular
Modulus of rupture of PCC = 675 psi
Shoulder = tied PCC shoulder
若條件不足，請自行做合理假設 (15%)
 - b. 請計算上述鋪面之應力，包括混凝土版最大應力，路基最大反力。(10%)
5. 請列舉三種常見之柔性鋪面分析程式，分別說明其程式理論背景，及比較優缺點。(10%)

Qualifying Examination (Finite Element Method)

1. A 10-unit force acts on point Q in the plane bilinear element shown in Fig.1. What the load vector $\{r_e\}_{8 \times 1}$ results?

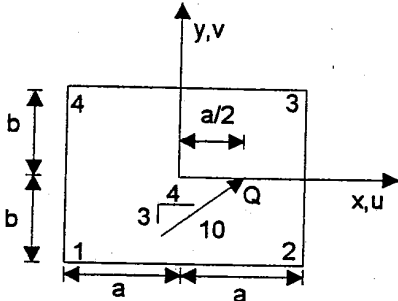


Fig.1

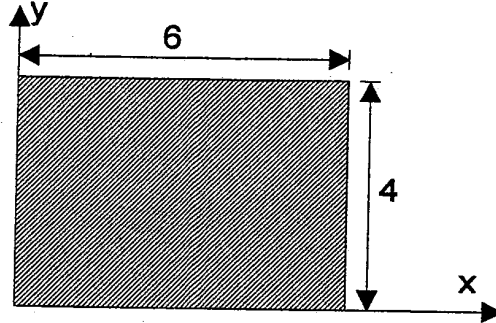


Fig.2

2. Use the 1 by 1 and 2 by 2 Gauss rule to approximate I over the rectangular region shown in Fig.2. $I = \iint \frac{3+x^3}{2+y^3} dx dy$

Order n	Sampling point	Weight factor
1	0	2
2	$\pm 1/\sqrt{3}$	1

3. Evaluate [J] (Jacobian matrix) and $\det[J]$ (determinant value) for each of the three elements shown in Fig.3. Also compute the ratio of element area to the area of a square two units on a side. How is this ratio related to $\det[J]$, and why?

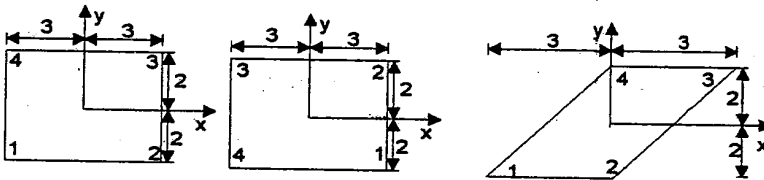


Fig.3

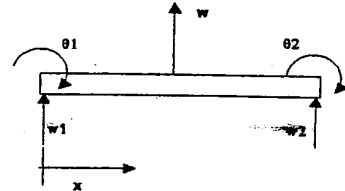


Fig.4

4. Prove the two-dimensional beam element stiffness as follows. The element degrees of freedom are shown in Fig.4. You must begin with the definition of shape

functions $(w = a_1 x^3 + a_2 x^2 + a_3 x + a_4 \quad \theta = -\frac{dw}{dx} = -3a_1 x^2 - 2a_2 x - a_3)$.

$$\begin{pmatrix} \frac{12x}{L^3} - \frac{6}{L^2} \\ \frac{4}{L} - \frac{6x}{L^2} \\ \frac{6}{L^2} - \frac{12x}{L^3} \\ -\frac{6x}{L^2} + \frac{2}{L} \end{pmatrix} \left\{ \left(\frac{12x}{L^2} - \frac{6}{L^2} \right) \left(\frac{4}{L} - \frac{6x}{L^2} \right) \left(\frac{6}{L^2} - \frac{12x}{L^3} \right) \left(-\frac{6x}{L^2} + \frac{2}{L} \right) \right\} dx = \frac{2EI}{L^3} \begin{bmatrix} 6 & -3L & -6 & -3L \\ -3L & 2L^2 & 3L & L^2 \\ -6 & 3L & 6 & 3L \\ -3L & L^2 & 3L & 2L^2 \end{bmatrix}$$