

Qualifying examination (Elasticity)

- (1) (a) Express the compatibility equations for the case of plane strain. (15%)
 (b) Given the plane strain distribution (10%)

$$\varepsilon_{xx} = 3x^2y$$

$$\varepsilon_{yy} = 4y^2x + 10^{-2}$$

$$\varepsilon_{xy} = yz + x^3$$

are the compatibility equations satisfied?

- (2) Consider two 90° rotations of axes x_1, x_2, x_3 - one about x_1 and one about x_3 . Show

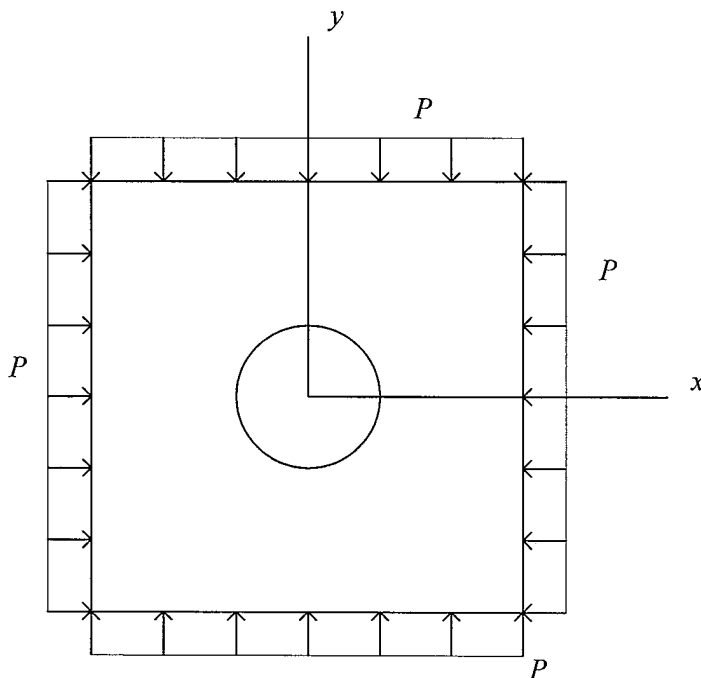
that for the elastic constants to be invariant with respect to both of these transformations, we must set (25%)

$$C_{1122} = C_{2233} = C_{3311} = C_{2211} = C_{3322} = C_{1133}$$

$$C_{2323} = C_{3131} = C_{1212}$$

$$C_{1111} = C_{2222} = C_{3333}$$

- (3) Determine the stress concentration factor for the 2-D infinite medium with a circular hole in it loaded as shown in Fig. below. The quantity P is a stress magnitude. (25%)



(4) The stresses in a circular cylinder of radius a with x_3 axis as the axis are given

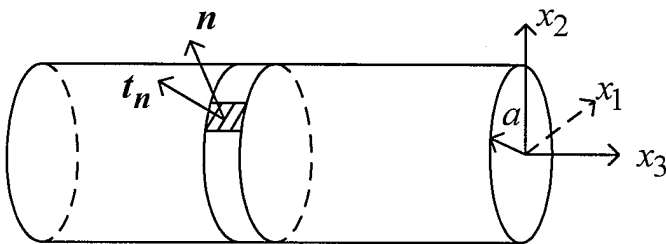
by

$$\sigma_{13} = \sigma_{31} = -\mu\beta x_2$$

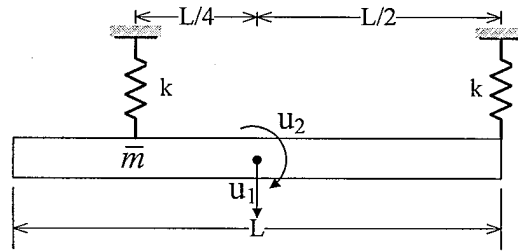
$$\sigma_{23} = \sigma_{32} = \mu\beta x_1$$

$$\sigma_{11} = \sigma_{22} = \sigma_{33} = \sigma_{12} = \sigma_{21} = 0$$

where μ and β are constants. Show that the lateral surface of the cylinder is traction free, i.e., show that $\mathbf{t}_n = 0$ on the surface shown in the figure. (25%)



- 請解釋下列名詞：(15%)
 - response spectrum
 - classical damping matrix
 - earthquake design spectrum
- Determine the natural frequencies and mode shapes for the uniform, rigid bar ($EI = \infty$) with mass \bar{m} per unit length. u_1 : translation, u_2 : rotation of the mass center. (30%)



- Please derive the complete solution for at-rest initial conditions of an undamped SDF system subjected to a harmonic force. i.e. $m\ddot{u} + ku = P_0 \sin \omega_n t$. Note: $\omega_n = \sqrt{k/m}$. (25%)
- Please find the displacements of the system (Fig. 4a) under the response-spectrum as shown in Fig. 4b. Solve this problem by using the square-root-of-sum-of-squares rule. (Given $m = 20 \text{ Ton}$ and $k = 100 \text{ kN/m}$) (30%)

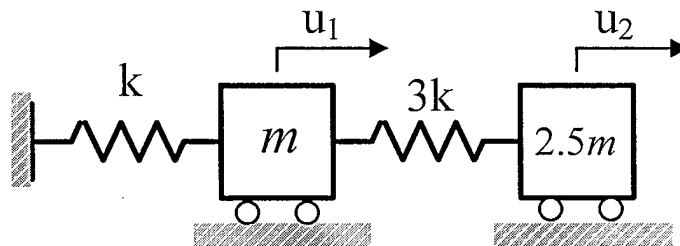


Fig. 4a

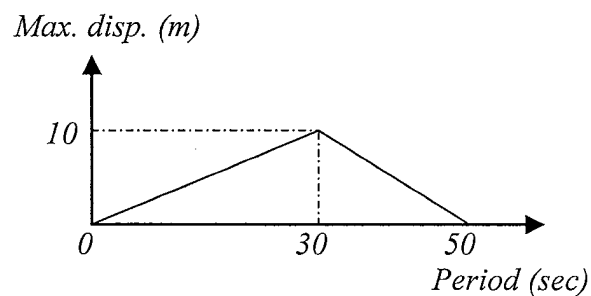


Fig. 4b

九十八學年度第一學期博士學位候選人資格考試

考試科目：工程地質

一. 解釋名詞 (34%)

- (1) 請繪出岩石循環圖(7%)
- (2) 何謂震央?震源?震度?地震規模?(8%)
- (3) 何謂交角不整合?非整合?假整合?(6%)
- (4) 何謂節理?何謂斷層?(4%)
- (5) 試述板塊邊界可分成哪幾種?(9%)

二. 分別以圖示 P 波、S 波、Raleigh wave 與 Love wave 波動傳遞與介質分子運動方式? (16%)

三. 試述 RMR 岩體分類法與 Q 法(14%)

四. 試由地質圖(圖 1)繪出 AB 剖面可能的地質情況 (12%)

五. 試問下列投影圖(圖 2)所示岩層的位態(8%)

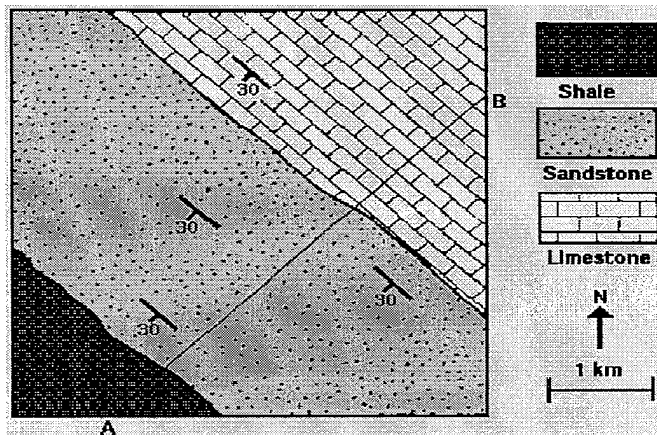


圖 1

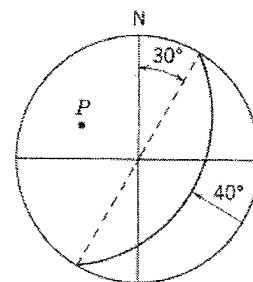


圖 2

六. 試定義(8%)並分別各舉出二種原生弱面與次生弱面(8%)。

98 學年度第一學期博士班資格考

科目:土壤力學

考試時間: 100 min

一、名詞解釋 (20 %):

1. Secondary compression
2. Overconsolidation ratio
3. Thixotropy
4. Critical void ratio

二、回答下列統一土壤分類法(Unified Soil Classification System) 之問題 (20 %):

1. 說明土壤分類之目的。
2. USCS 中主要之四種主要土壤種類及分類依據。
3. 進行完整土壤分類所需進行之試驗項目及各試驗之目的。

三、回答下列有關應力路徑(Stress paths)的問題 (20 %):

1. 說明何謂應力路徑及其發展之目的。
2. 繪出 $K_0 < 1$ 之 NC 土壤在下列情況下之應力路徑:
 - (a). 排水狀況下基礎下方土壤加載至破壞。
 - (b). 排水狀況下擋土牆後土壤主動破壞。
 - (c). 排水狀況下擋土牆後土壤被動破壞。
 - (d). 不排水狀況下三軸壓縮試驗總應力與有效應力路徑。
3. 推導 p-q diagram 強度參數(a, ψ)及 Mohr-coulomb 強度參數(c, ϕ) 之關係。

四、回答下列有關土壤夯實(soil compaction)的問題 (20 %):

1. 說明何謂土壤夯實及其原理。
2. 推導理論 zero air voids curve ($\rho_d = \rho_w S / (w + \rho_w S / \rho_s)$)。
3. 說明現地如何進行夯實品管。
4. 說明如何決定每層土壤夯實厚度。

五、回答下列有關土中水的問題 (20 %):

1. 說明何謂虹吸現象(capillarity) 及其對現地土壤之影響。
2. 推導土中穩態滲流(steady state seepage) 之控制方程式及對應之假設。
3. 列出求解滲流控制方程式之方法及其適用性。

2009 年 10 月 30 日

成大土木系博士班資格考試 軌道工程試題

一、以下各小題討論列車的脫軌。

1. 何謂脫軌？
2. 影響列車脫軌行為的因素有哪些，如何影響？

二、在過去數十年中，世界上許多鐵路系統皆經歷鐵路改革。

1. 是什麼樣的因素促使這些鐵路系統進行改革？
2. 我國的臺鐵及高鐵是否也需要改革，為什麼？主事者應該考慮
哪些因素以決定是否需要改革以及改革的內容？

三、本題與軌道的超高有關。

1. 為何軌道需要設置超高？
2. 何謂超高不足與超高過量？
3. 為何設計軌道時需要考慮超高不足與超高過量？

**National Cheng Kung University
Department of Civil Engineering
Pavement Engineering
Qualification Exam for Ph.D. Students
Open Books and Notes (100 minutes)
Fall 2009**

1.

Explain the following terms:

(a) permeable pavement, (b) drainage pavement, (c) rigid pavement, (d) JRCP, (e) rubberlization (25%)

2.

What are the new features of AASHTO Mechanistic-Empirical Pavement Design Guide (ME-PDG)? (25%)

3.

What are the major road tests since 1950? Why are these road tests important to pavement engineering? (25%)

4.

What are the major differences in highway and airport pavement designs? (25%)

鋼鐵材料與結構

2009.10.30

考試方式: **Closed Book**

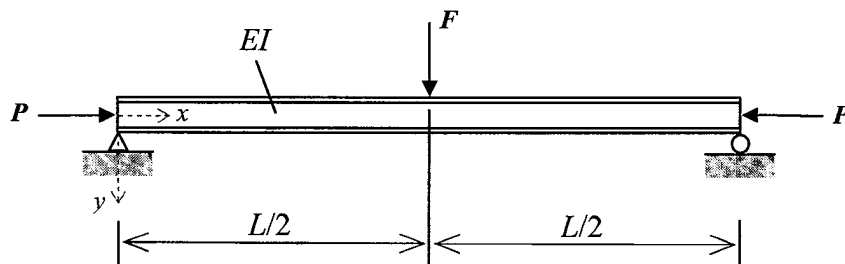
考試時間: 100分鐘

1. (40%) Please give detailed explanations for the following questions:

- Please describe how the four chemical elements, phosphorous (P), sulfur (S), hydrogen (H) and nitrogen (N), affect the properties of steel.
- What is “lamellar tearing” phenomenon in steel material? How does it happen? How to solve this problem?
- We usually categorize carbon steels into four categories by their carbon percentages. What are these four categories and their carbon percentages?
- Please list at least two methods to measure the toughness of steel and clearly describe these methods.

2. (15%) In LRFD steel design, we use $0.6F_y$ (or $0.6F_u$) as the shear strength of steel to evaluate the shear forces of steel components. Where is the coefficient 0.6 from? Please try to derive it. (F_y and F_u are the yield and ultimate strength of steel respectively from the tensile test)**3. (25%) Consider the following simply-supported beam-column with a concentrated load (F) at the mid-span.**

- Please derive the y -direction deflection formula $w(x)$ for this beam-column.
- Please derive the moment formula $M(x)$ for this beam-column
- Please obtain the theoretical moment magnification factor MAF (or B_1) for this beam-column.



Note: Assume linearly-elastic material

4. (20%) Please list the limit states considered for designing the welded/bolted double angle connection shown in the following figure.

