Qualifying examination (Elasticity)

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

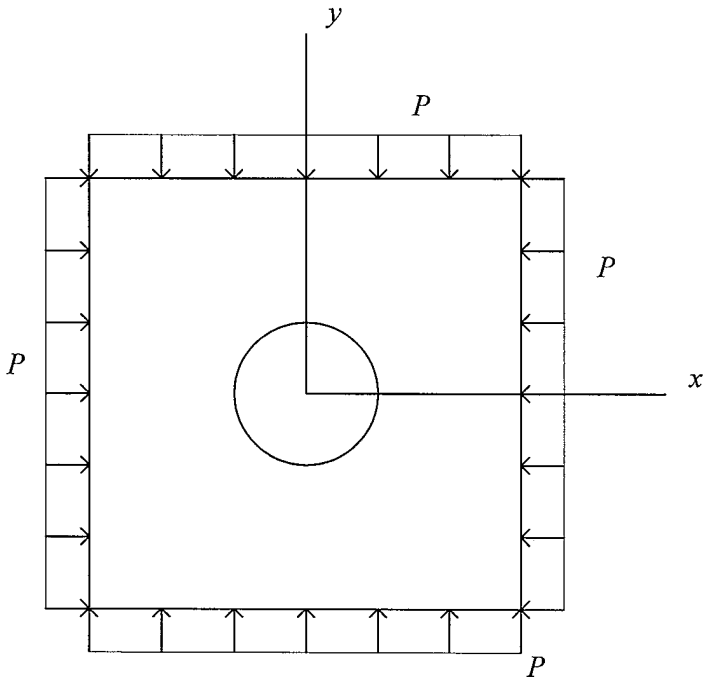
$$\varepsilon_{xx} = 3x^2 y$$
$$\varepsilon_{yy} = 4y^2 x + 10^{-2}$$
$$\varepsilon_{xy} = yz + x^3$$

are the compatibility equations satisfied?

(2) Consider two 90^0 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%)

$$C_{1122} = C_{2233} = C_{3311} = C_{2211} = C_{3322} = C_{1133}$$
$$C_{2323} = C_{3131} = C_{1212}$$
$$C_{1111} = C_{2222} = C_{3333}$$

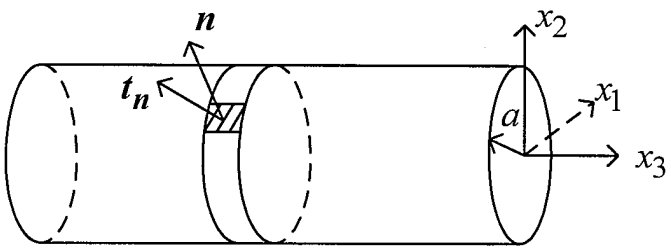
(3) Determine the stress concentration factor for the 2-D infinite medium with a circular hole in it loaded as shown in Fig. below. The quantity P is a stress magnitude. (25%)



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

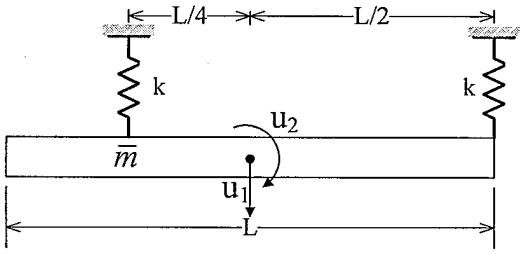
$$\sigma_{13} = \sigma_{31} = -\mu\beta x_2$$
$$\sigma_{23} = \sigma_{32} = \mu\beta x_1$$
$$\sigma_{11} = \sigma_{22} = \sigma_{33} = \sigma_{12} = \sigma_{12} = 0$$

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%)



1. 請解釋下列名詞：(15%)
   (a) response spectrum
   (b) classical damping matrix
   (c) earthquake design spectrum

2. 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 %)



3. 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%)

4. 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 $m = 20\,Ton$ and $k = 100\,kN/m$) (30%)

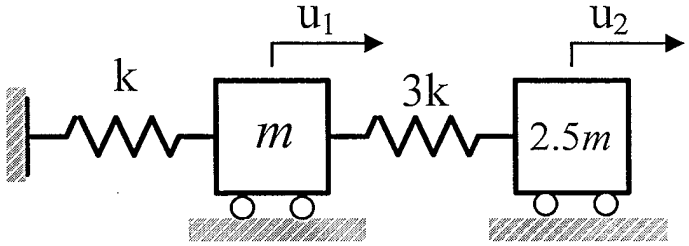


Fig. 4a

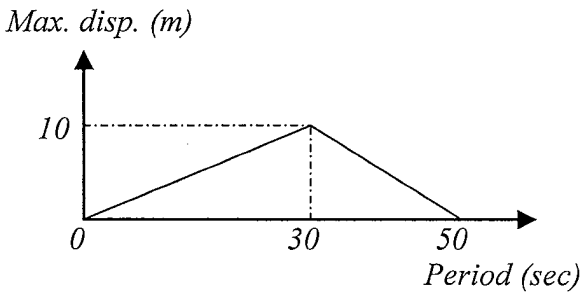


Fig. 4b

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%)

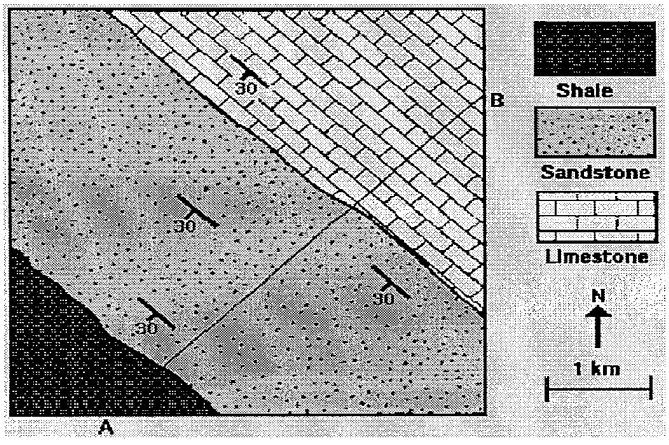


圖 1

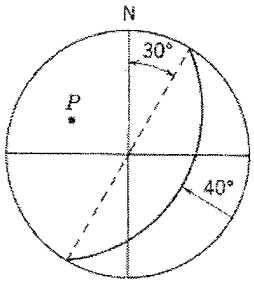


圖 2

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:

(a) Please describe how the four chemical elements, phosphorous (P), sulfur (S), hydrogen (H) and nitrogen (N), affect the properties of steel.

(b) What is "lamellar tearing" phenomenon in steel material? How does it happen? How to solve this problem?

(c) We usually categorize carbon steels into four categories by their carbon percentages. What are these four categories and their carbon percentages?

(d) Please list at least two methods to measure the toughness of steel and clearly describe these methods.

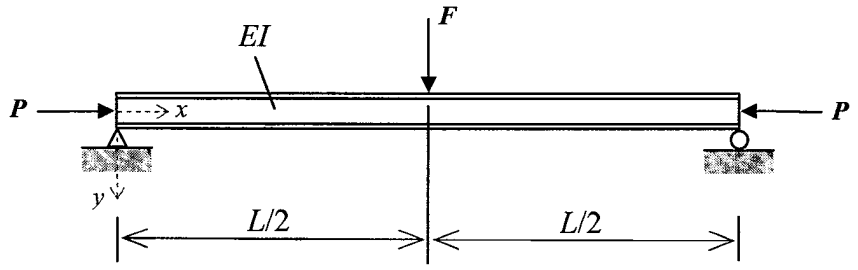
2. (15%) In LRFD steel design, we use $0.6F_y$ (or $0.6F_u$) as the shear strength of steel to evaluate the shear forces of steel components. Where is the coefficient 0.6 from? Please try to derive it. (F_y and F_u are the yield and ultimate strength of steel respectively from the tensile test)

3. (25%) Consider the following simply-supported beam-column with a concentrated load (F) at the mid-span.

(1) Please derive the y-direction deflection formula $w(x)$ for this beam-column.

(2) Please derive the moment formula $M(x)$ for this beam-column

(3) 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.