九十二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		考試地點
8:30 ｜ 10:10	√▲ 有限元素法 （可帶計算機）	(CLOSE BOOK)	大地工程館 一樓47140室
	√▲ 鋼結構學	(OPEN BOOK)	
10:20 ｜ 12:00	√▲ 結構動力學	(CLOSE BOOK)	大地工程館 一樓47140室
	▲ 混凝土組合律	(CLOSE BOOK)	
	√▲ 工程成本與財務	(CLOSE BOOK)	
	√▲ 施工學	(CLOSE BOOK)	
	▲ 基礎工程	(OPEN BOOK)	
13:30 ｜ 15:10	√▲ 土壤力學	(CLOSE BOOK)	大地工程館 一樓47140室
	√▲ 岩石力學	(CLOSE BOOK)	
	√▲ 工程時程控制	(CLOSE BOOK)	
	√▲ 工程數學	(CLOSE BOOK)	
	√▲ 鋪面工程	(CLOSE BOOK)	
	√▲ 工程資訊管理	(OPEN BOOK)	
15:20 ｜ 17:00	√▲ 工程地質	(CLOSE BOOK)	大地工程館 一樓47140室
	√▲ 路面材料	(CLOSE BOOK)	

- 考試日期：92年10月30日（星期四）
- 地　　點：土木系大地工程館一樓47140室
- 考試時請攜帶學生證。

Qualified Examination

Fall 2003

Finite Element Method

(Close book, 60% to pass)

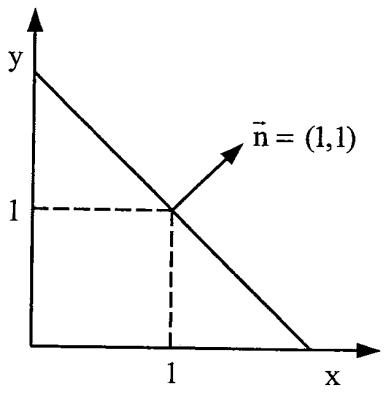
1. The strain field in a triangular region bounded by $x = 0$, $y = 0$, $x + y = 2$ is assumed to be of the form

$$\varepsilon_x = a_1 x + a_2 y$$

$$\varepsilon_y = b_1 x + b_2 y$$

$$\gamma_{xy} = c_1 x + c_2 y$$

with body forces $F_x = d$ = constant and $F_y = 0$.



unit in inches

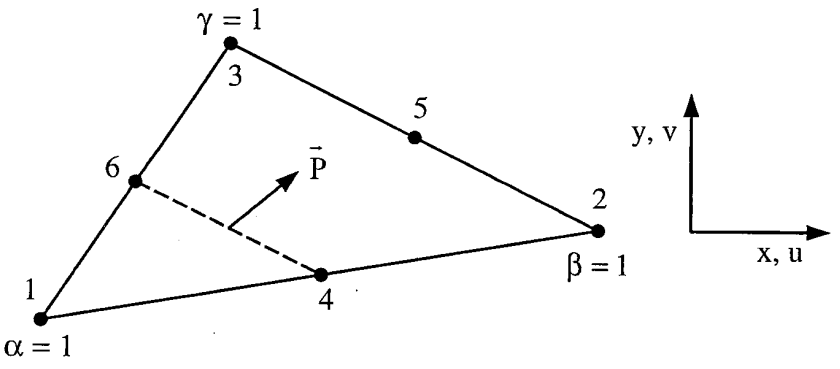
(i) At the position $(x,y) = (1,1)$, use the stress-strain matrix

$$[E] = \begin{bmatrix} 1000 & 300 & 0 \\ 300 & 1000 & 0 \\ 0 & 0 & 100 \end{bmatrix} \text{ksi}$$

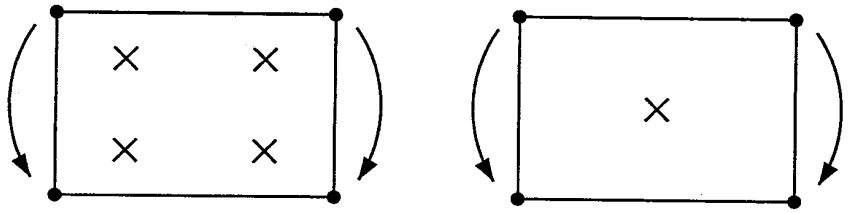
to compute σ_x, σ_y, τ_{xy} and the stress component σ_n in the $\vec{n}$ direction. (15%)

(ii) Write an equation in terms of a_1, a_2, b_1, b_2, c_1, c_2 and d to guarantee equilibrium in the x direction. (5%)

2. A linear strain triangle element in the area coordinates (α,β,γ) is shown below. The element nodal load vector for the element is $\{Q\} = \{q_{1x}, q_{1y}, q_{2x}, q_{2y}, q_{3x}, q_{3y}, q_{4x}, q_{4y}, q_{5x}, q_{5y}, q_{6x}, q_{6y}\}^T$. A concentrated load, $\vec{P} = P_1\vec{i} + P_2\vec{j}$, is applied halfway between nodes 6 and 4, where $\vec{i}$ and $\vec{j}$ are unit vectors in x and y directions, respectively. (i) What are the area coordinates of the location at which $\vec{P}$ is applied? (Hint: $\alpha + \beta + \gamma = 1$) (ii) Compute the equivalent nodal load vector $\{Q\}$ for $\vec{P}$. (20%)



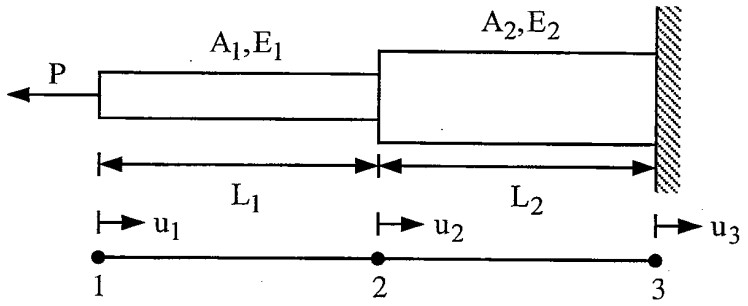
3. (i) What is shear locking (or parasitic shear)? Use the linear element subjected to pure bending and with full integration rule to explain this phenomenon. How to avoid it? (10%)
   (ii) What is zero energy mode (or hourglass mode)? Use the linear element subjected to pure bending and with reduced integration rule to explain this phenomenon. How to avoid it? (10%)



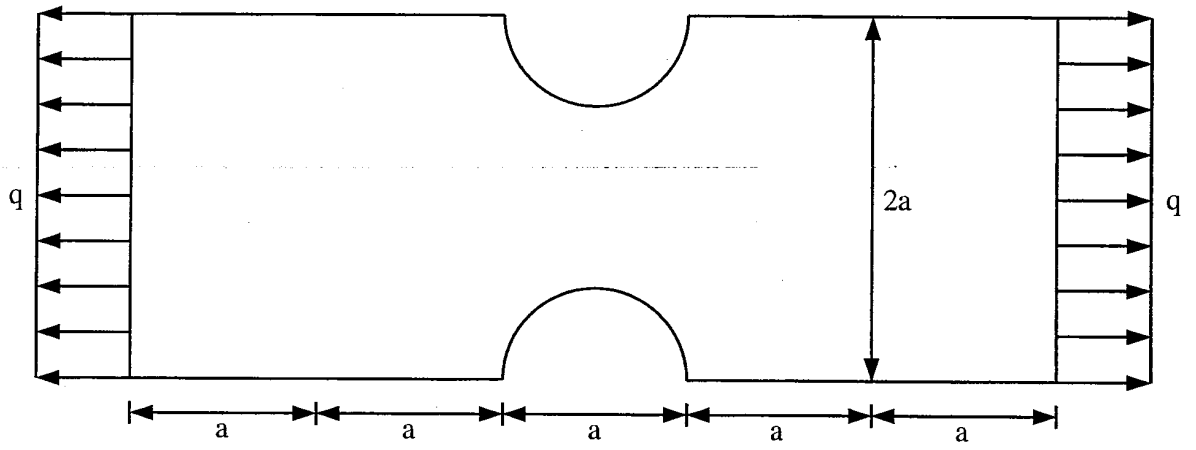
Full integration Reduced integration

× represents the locations of integration points

4. An axially loaded bar structure shown below is modeled by two bar elements. Use the finite element method to (i) formulate the structural stiffness for the bar structure, (ii) calculate the displacements u_1, u_2, and (iii) compute the strains and the stresses in both bar elements. (20%)



5. A tension bar with uniform thickness and with notches is subjected to uniaxial tensile stress q as shown. (i) Sketch the mesh and describe the best type of element that you would use to analyze the bar (need to take the symmetric conditions into account). (ii) Specify the boundary conditions on your mesh. (20%)



STEEL STRUCTURE

1. Determine the capacity of the splice shown in Fig.1. All plate materials are A36 steel (Fy=36 ksi, Fu=60 ksi). Fasteners are 1-in A325 bolts (Fv=30 ksi) in a bearing-type connection with threads excluded from the shear planes. Standard holes. Please use allowable-stress-design (ASD) method to solve this problem.

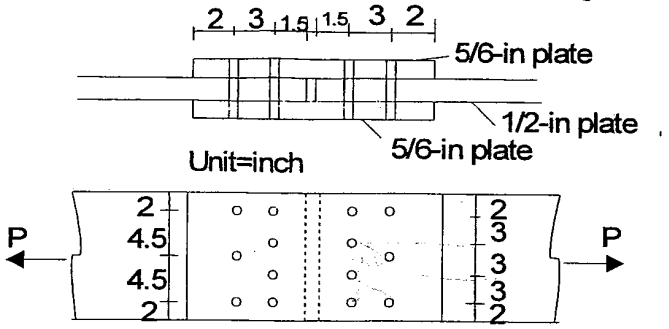


Fig.1

2. Use LRFD method to do problem 1 again. ($R_n=60A_b$)

3. Do the analysis work for the problem in Fig.2. The member is W12x35, and material is A572 grade 50 steel, Fy=50 ksi. (W12x35, d=12.5, tw=0.3, bf=6.56, tf=0.52, A=10.3 in^2, rx=5.25, ry=1.54, r_T=1.74, Sx=45.6 in^3, Sy=7.47 in^3; unit=in)

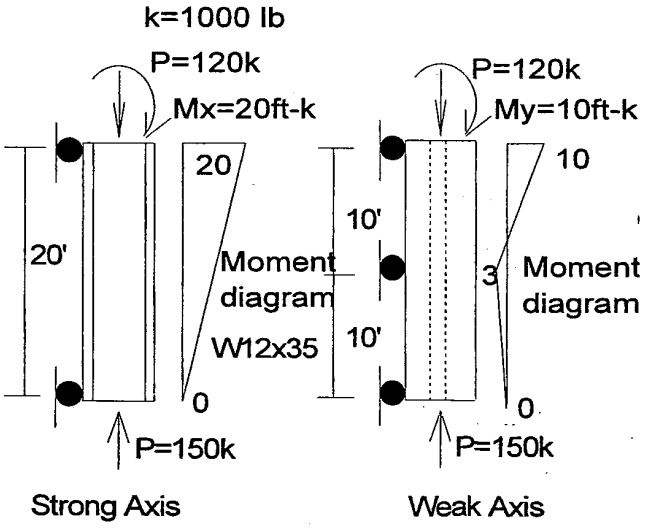


Fig.2

九十二學年度第一學期土木所博士學位候選人資格考試

考試科目： **結構動力學**
作答方式： **Close Book**
考試時間： 100分鐘
及格標準： 共五題，每題配分于后，**65**分通過資格考試。

一、 某一單自由度黏滯阻尼線性系統分別承受下列三種振動狀況時，若僅有系統加速度反應 $a(t)$ 的一組量測歷時，試問如何精確或大致推估該系統的自然頻率和阻尼比？

(a) 自由振動；（**5**分）
(b) 外力非常窄頻的強迫振動；（**10**分）
(c) 外力非常寬頻的強迫振動。（**10**分）

二、 某一單自由度黏滯阻尼線性振動系統，其自然頻率為 ω_n，阻尼比為 ζ，初始條件為 $u(0^-)=\dot{u}(0^-)=0$，可能同時承受外力為 $p(t)$ 的強迫振動和基底加速度為 $a_g(t)$ 的基底振動。

(a) 若 $p(t)=0$，且 $a_g(t)=a_0\Delta t\delta(t)$，即瞬間基底加速度，其中 a_0 和 Δt 為已知值，試求該系統相對於基底的位移和速度反應之最大值。（**10**分）
(b) 若 $p(t)=ma_1\sin\omega t$，且 $a_g(t)=a_2\Delta t\delta(t)$，其中 a_1、a_2、ω 和 Δt 為已知值，且 $\omega\neq\omega_n$，m 為系統質量，試求該系統相對於基底的位移反應 $u(t)$。（**15**分）

三、 某一單自由度黏滯阻尼線性系統承受外力 $p(t)=\sin\omega t$，在相同阻尼比和初始條件下，頻率比 ω/ω_n 愈小，系統位移反應愈快趨近穩態解。試以兩種不同的數學公式或振動觀念，解釋上述現象。（**15**分）

四、 某一兩層樓建築物承受基底振動 $a_g(t)$，一樓質量為 $2m$，與基底之間的勁度為 $2k$；二樓質量為 m，與一樓之間的勁度為 k。

(a) 試求兩振態頻率之比值。（**5**分）
(b) 試求兩振態的有效質量之比值。（**10**分）
(c) 當 $a_g(t)=\sin\omega t$ 時，使系統穩態反應的振幅最小之 ω，稱為反共振頻率。假設各振態的阻尼比均為0%，試分別求一樓和二樓相對於基底的位移反應的反共振頻率與基本振態頻率之比值。（**10**分）

五、 建築物於柱頭或柱腳補強時，採用碳纖維貼片可增加柱之強度，但不影響勁度；採用鋼鈑可增加柱之強度和勁度。試僅以上述觀點，評論兩種補強方法之優劣。（**10**分）

混凝土組合律
博士資格考 Fall 2003

1. Explain the following failure plane or failure criteria (a) Rendulic plane (b) Tresca (c) von Mises (d) Coulomb-Mohr. (25%)

2. A simply-supported beam made from a concrete is under a central concentrated load P; the span= S, the height= H and the thickness of the beam= B. If the stress relaxation rate of the concrete is described well by the following equation: $\dot{\sigma} = A\varepsilon^n$. Calculate the force relaxation rate dP/dt if the central deflection of the concrete beam is fixed to be δ. Discuss your result for the limiting cases of an elastic beam and a plastic beam. (25%)

3. Describe the maximum pull-out load versus embedded fiber length for various interfacial friction conditions: (a) $\tau_{fu}/\tau_{au} \geq 1$ (b) $0 < \tau_{fu}/\tau_{au} < 1$ and (c) $\tau_{fu}/\tau_{au} = 0$. Here, τ_{au} is the adhesional shear strength and τ_{fu} is the shear stress at the debonded zone in a fiber reinforced concrete. (25%)

4. Describe the stress-strain curve and corresponding failure mechanism for
   (a) A cellular concrete under compression.
   (b) A high strength concrete under tension.
   (c) A lightweight-aggregate concrete under compression.
   (d) A normal strength concrete under compression. (25%)

工程成本與財務　博士資格考　92 年 10 月

一、 近年來營建業經歷經濟不景氣，請問，營造廠的損益表、資產負債表中，哪些科目的數字會有較大的變化？增加或減少？爲甚麼？(30 分)

二、 請自行用六筆交易或會計事項，最好涵蓋資產、負債、業主權益、收入及費用類科目，做分錄於日記簿，過帳至分類帳或 T 字帳，然後結帳，做損益表，及資產負債表。(40 分)

三、 請敘述成本控制的流程。於此流程中，甚麼工作最不容易？原因爲何？有何克服方法？ (30 分)

九十二學年度第一學期博士班資格考　科目：施工學　2003.10

一、簡答題（30%）

（1）說明何謂施工學？

（2）潛盾工法種類

（3）隧道 TBM 施工法

（4）隧道 NATM 施工法

（5）隧道開挖過程中，何謂超挖？

二、請繪圖並說明拱肋迴降工法（Arch lowing method）施工重點(10%)

三、請以簡單圖示與文字說明混凝土壩施工巨積混凝土施工過程中(1)如何控制溫度(2)如何分塊澆置又能持壩體完整性之各項作法與施工要點。(20%)

四、請依據（1）施工條件（2）構想與基本原理（3）實施方法與步驟（4）適用性檢討與替代方案（5）應變補助與搶救方案，分項簡述你所知道某一案例中之工程背景與其採用之施工法(40%)

博士班資格考試—「基礎工程」試題　　92.10.30

1. For a shallow foundation, B = 0.8 m, L = 1.2 m, and D_f = 0.8 m. The known soil characteristics are as follows :

Soil: $\phi' = 28^o$

$c' = 50kN/m^2$

$\gamma = 17.8kN/m^3$

Modulus of elasticity, $E_s = 580kN/m^2$

Poisson's ratio, $\mu_s = 0.33$

Calculate the ultimate bearing capacity. (Note: Using the method proposed by Vesic(1973))　(25%)

2. A foundation measuring 10 ft × 10 ft has to be constructed in a granular soil deposit. For this foundation, D_f = 5 ft and $\gamma = 115lb/ft^3$. Following are the results of a standard penetration test in that soil:

Depth (ft)	Field standard penetration number, N_{60}
5	10
10	12
15	9
20	13
25	16
30	18
35	24
40	30

Using Eq. (1) to estimate an average friction angle ϕ' (for bearing capacity calculation) for the soil.　(25%)

$$\phi' = \tan^{-1}\left[\frac{N_{60}}{12.2 + 20.3\left(\frac{\sigma_0'}{p_a}\right)}\right]^{0.34} \qquad \text{Eq.(1)}$$

Where N_{60} = field standard penetration number

σ_0' = effective overburden pressure

p_a = atmospheric pressure in the same unit as σ_0'

ϕ' = soil friction angle

3. For the braced cut shown in Fig. 1, H = 8m; H_s = 3m; $\gamma_s = 16.8kN/m^3$; the angle of friction of sand, $\phi_s' = 32^o$; H_c = 5m; $\gamma_c = 18.2kN/m^3$; and the unconfined compression strength of clay layer, $q_u = 72kN/m^2$.

a. Estimate the average cohesion, c_{av}, and average unit weight, γ_{av}, for development of the earth pressure envelope. Use n'= 0.75 as the coefficient of progressive failure. (10%)

b. Plot the earth pressure envelope. (15%)

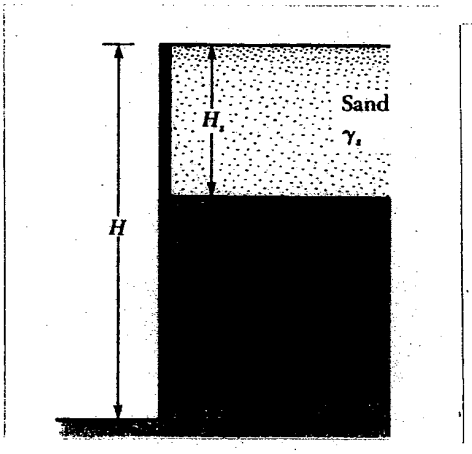


Fig. 1

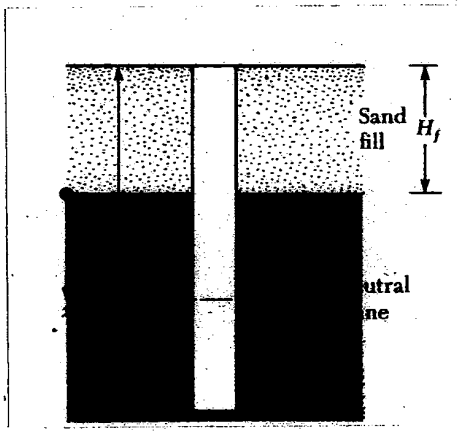


Fig. 2

4. In Fig. 2, let H_f = 3m, pile diameter = 0.45m, $\gamma_f = 16.8kN/m^3$, $\phi_{clay}' = 32^o$, $\gamma_{sat(clay)} = 17.5kN/m^3$, and L = 24m. The water table coincides with the ground surface. Determine the downward drag force. Assume that $\delta = 0.6\phi'_{clay}$. (25%)

Where N_{60} = field standard penetration number

σ_o' = effective overburden pressure

p_a = atmospheric pressure in the same unit as σ_o'

ϕ' = soil friction angle

3. For the braced cut shown in Fig. 1, H = 8m: H_1 = 3m: $\gamma_1 = 16.8kN/m^3$: the angle of friction of sand, $\phi_1' = 32°$: H_2 = 5m: $\gamma_2 = 18.2kN/m^3$: and the unconfined compression strength of clay layer, $q_u = 72kN/m^2$.

a. Estimate the average cohesion, c_{av}, and average unit weight, γ_{av}, for development of the earth pressure envelope. Use n' = 0.75 as the coefficient of progressive failure. (10%)

b. Plot the earth pressure envelope. (15%)

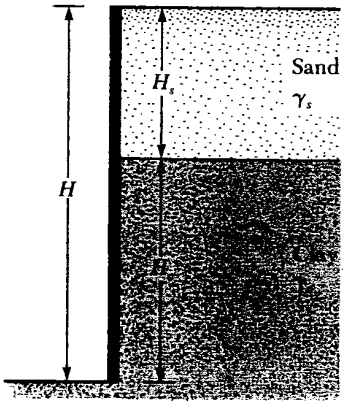


Fig. 1

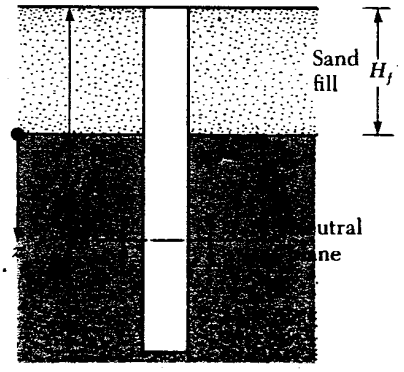


Fig. 2

4. In Fig. 2, let H_f = 3m, pile diameter = 0.45m, $\gamma_1 = 16.8kN/m^3$, $\phi_{1,av}' = 32°$, $\gamma'_{clay} = 17.5kN/m^3$, and L = 24m. The water table coincides with the ground surface. Determine the downward drag force. Assume that $\delta = 0.6\phi'_{1,av}$. (25%)

92.11 博士班資格考

1. 說明 Terzaghi 單向度壓密理在實用上的限制 (25 分)。

2. 說明目前常用之土壓力理論及其實用上之限制 (25 分)。

3. 說明管湧(Piping)、流砂(Quick sand)、液化(Liquefaction)之異同點 (25 分)。

4. 說明土壤之臨界狀態(Critical state)及 Cam-clay model (25 分)。

92學年博士課程資格考試高等岩石力學試題(2003.10)

1. 如何求得岩盤的現地應力，使用原理有那些？並舉實例說明。(20%)
2. 圍壓、溫度、含水量、加壓速率等對岩石材料的應力－應變曲線以及破壞形式有何影響？(20%)
3. 岩盤的特性對隧道工程、邊坡工程及壩基工程的影響為何？影響之大小順序為何？(20%)
4. 如何求取具有節理面的岩石材料之強度參數，詳細說明之。(20%)
5. 何謂①關鍵岩塊(Key Block)
   ②破壞準則(Failure Criteria)
   ③節理(Joint)
   ④岩盤評分(Rock Mass Rating)
   ⑤崩解耐久指標(Slake Durability Index) (20%)

工程時程控制　博士資格考　92 年 10 月

一、 請說明已獲價值法(earned value method)的重點。(25 分)

二、 某工作有下列作業與關係，請劃出網圖，計算各作業最早、最晚時間，指出要徑及工期。(25 分)

作業	工期	後續作業	關係延時
A	5	B	SS1，FF8
		C	SS2，SF8
B	10	D	SS5
C	4	D	SS7，FF10
D	15		

三、 某工作之工期分佈爲一梯形，最短時限爲 24 天，最長時限 46 天，中間時間 (mode) 爲 36 天。請計算此工作在 40 天內完成的機率。(25 分)

四、 何謂進度表體系 (Hierarchy of schedules)？其在不同階層上，該如何搭配運用網圖及桿狀圖，原因爲何？(25 分)

Qualifying Examination
(Engineering Mathematics)
(Closed books)

1. Let

$$A=\begin{pmatrix} 0 & c & -b \\ -c & 0 & a \\ b & -a & 0 \end{pmatrix}$$

where a,b,c$\in R$ and a,b,c$\neq 0$.

a) Calculate the eigenvalues and eigenvectors of A.(15%)

b) Calculate $e^{\mu A}$ *where* $\mu \in R$.(5%)

2. If $x=r\cos\theta$ and $y=r\sin\theta$, determine expression for $\left(\frac{\partial r}{\partial \theta}\right)_x$ and express result as a function of r and θ.(10%)

3. Evaluate using complex variables

$$\int_0^\infty \frac{\sin x}{x}dx \quad (15\%)$$

4.For $x\in R^d$, let $r=(x_1^2+x_2^2+\cdots+x_d^2)^{1/2}$ and show that if $\varphi=\varphi(r)$, then

$$\nabla^2\phi=\phi''+\frac{d-1}{r}\phi' \quad ,r>0$$

and conclude that each radially symmetric harmonic function in $R^d-\{0\}$ is of the form

$$\phi(r)=a+\frac{b}{r^{d-2}}, \; if \; d>2$$

where a and b are constants.(15%)

What is the form when d=2. (10%)

5. Obtain the solution of the problem

$y'' + \lambda y = h(x)$, $y(0) = 0 = y(l)$

in the form

$$y(x) = \sum_{n=1}^{\infty} \frac{a_n}{\lambda - \pi^2 n^2 / l^2} \sin \frac{n\pi x}{l} \quad (0 \le x \le l)$$

when $\lambda \neq (n\pi / l)^2$ (n=1,2.3,....), where a_n is the nth coefficient in the expansion

$$h(x) = \sum_{n=1}^{\infty} a_n \sin \frac{n\pi x}{l} \qquad 0 < x < l$$

assuming that h(x) is piecewise differentiable in $(0, l)$. (15%)

6. Use Stokes's theorem to determine the value of the integral

$$\iint_S (\nabla \times V) \cdot n ds$$

over the part of the unit sphere $x^2 + y^2 + z^2 = 1$ above the xy plane, where $V = yi$. (15%)

國立成功大學土木工程系 92 學年度第一學期博士班資格考試

鋪面工程試題

Close book

I. 請從下列角度說明剛性鋪面與柔性鋪面的差異。(15%)

1. 鋪面結構特性
2. 分析理論

II. 路面在完工通車後幾個月之內就發生嚴重車轍，同時車轍處出現嚴重鱷魚皮狀龜裂。請敘明您診斷發生成因的規劃與理由。(15%)

III. FWD 是目前最廣泛利用的路面結構檢測方法之一。(20%)

1. FWD 試驗量測什麼數據？
2. 量測所得的數據經過處理可以推測什麼？
3. 目前常見的反算程式的原理爲何？
4. 反算結果往往被受質疑，您認爲原因有哪些？

IV. 若以剛性路面分析程式估計柔性路面的變形量，您認爲會超估或低估？原因爲何？ (10%)

V. 路基材料強度在一年四季會隨季節雨氣候而變動。請說明鋪面設計過程中，您會如何選擇設計強度？理由何在？(15%)

VI. 請翻譯下面短文。(25%)

A PMS is not a maintenance management system. A maintenance management system (MMS) is concerned with maintenance activities that apply from "property line to property line." Such activities as little pick-up, vegetation control, culverts and routine maintenance of pavements are included in an MMS. Pavement management systems can provide information pertinent to the scheduling of routine pavement maintenance, but do not deal with other activities, such as little pick-up.

A PMS is not a substitute for good quality control. Pavements built poorly with substandard materials perform poorly regardless the best maintenance or rehabilitation policy. Developing a database of information for a PMS helps quantify performance predictions and cost consequences of using poor materials or reduced control.

A road inventory summarizing pavement conditions is not a PMS. Such information is inadequate for answering "what," "when" and "where." "Where" can be answered by a road inventory only if performance standards are set.

Construction Management Information System
Qualification

1. (10%)
   1.1. What is Data Warehouse?
   1.2. Data Mining?
   1.3. Please describe how to apply these two approaches to the construction related business.
2. (10%)
   2.1. What is SCM (Supply Chain Management)?
   2.2. Please list at least three different reasons that construction industry should develop SCM.
3. (15%)
   3.1. List five different types of database?
   3.2. Explain their structures and pros and cons.
   3.3. List the example of applicable filed for each of the five different types of database.
4. Please explain INTERNET, INTRANET, and EXTRANET. (15%)
5. Table 1 contains many unsatisfactory components and characteristics. (For example, there are several multi-valued attributes, naming conventions are violated, and some attributes are not atomic, etc.)

Table 1

Attribute name	Sample value
EMP_CODE	1003
LAST_NAME	Willaker
EDUCATION	HS, BBA, MBA
DEPT_CODE	MKTG
DEPARTMENT	Marketing
DEPT_MANAGER	Jill H. Martin
JOB_CLASS	23
TITLE	Sates agent
DEPENDENTS	Gerald (spouse), Mary (daughter), John (son)
BIRTH_DATE	12/23/65
HIRE_DATE	10/14/94
TRAINING	Level I, level 2
BASE_SALARY	$32,255

5.1. Given this table, draw its dependency diagram. Label all transitive and/or partial dependencies. (15%)
5.2. Break up the dependency diagram you drew in problem 4.1 to produce dependency diagrams that are in 3NF. (15%) Hint: You might have to create a few new attributes. Also, make sure

that the new dependency diagrams contain attributes that meet proper design criteria; that is, make sure there are no multi-valued attributes, that the naming conventions are met, and so on.

5.3. Using the results of 4.2, draw the E-R diagram. (10%)

5.4. Using the results of problem 4.2, draw the relational schema, including the connectivities between entities. (10%)

九十二年度第一學期博士候選人資格考工程地質試題

一、翻譯及解釋下列名詞: (25%)

(1) subduction zone
(2) unconformity
(3) thrust fault
(4) RQD
(5) Erosion

二、何謂節理？何謂斷層？何謂褶皺？其形成之原因各為何？試述其對岩體之影響為何？ (25%)

三、何謂原生弱面？何謂次生弱面？簡述岩石弱面對岩體之影響為何？ (25%)

四、試述岩盤中之弱面對壩基、隧道、邊坡施工之影響。 (25%)

路面材料 （總分 100 分，70 分及格）

1. Briefly describe the asphalt refining procedures.（16 分）

2. Describe the asphalt cement grading system.（16 分）

3. Describe the Superpave asphalt binder testing equipment and purpose.（18 分）

4. Describe the Superpave mix design method.（18 分）

5. Describe the two principal types of HMA mixing facilities in use today.（16 分）

6. What are the purposes of using additives and modifiers in HMA?（16 分）