

97 年度博士班入學考試大地工程試題

一、翻譯及解釋（或說明）下列名詞之意義。(24%)

- (1) seepage force
- (2) quick clay
- (3) excess pore water pressure
- (4) plate tectonics
- (5) Neutral plane
- (6) RQD

二、何謂塑性圖(plasticity chart)? 其有何用途? 試說明之。(10%)

三、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%)

四、(a) 何謂原生弱面? 並各列舉至少兩個原生弱面名稱。

(b) 何謂次生弱面? 並列舉至少六個次生弱面名稱。

(c) 簡述岩石弱面對岩石力學性質之影響為何? (25%)

五、(a) 何謂負摩擦力(negative skin friction)? (b)其影響如何? (c)在何種情況下

需考慮基樁之負摩擦力? (16%)

Part I

I-1. Briefly describe the Superpave mix design method. (40%)

I-2. What kind of properties should the ideal pavement binder have? (30%)

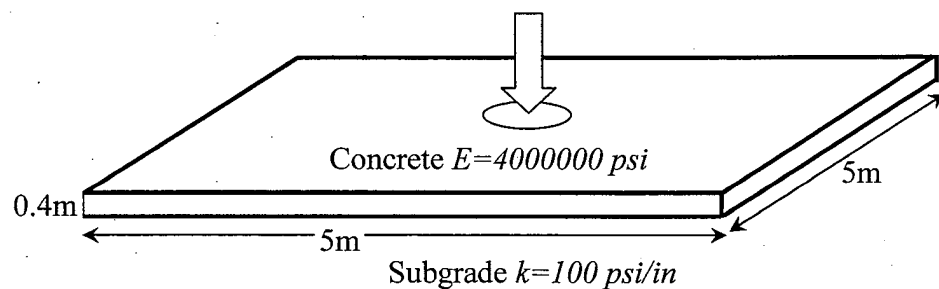
I-3. Translation (30%)

Many engineers and technicians from all sectors of the asphalt business who entered the work force during the early days of the construction of the interstate system are reaching the end of their careers. These people must be replaced by engineers and technicians who are knowledgeable of asphalt materials and their proper use to successfully rebuild the highway sector of the transportation infrastructure.

Part II

II-1. For the slab shown as below

- a) How would you explain the causes of discrepancies between results of Westergaard's solutions and finite element analysis? (15%)
- b) Is it possible to obtain accurate solutions with the two approaches mentioned in the previous question? If yes, which one? and why? If not, why? (15%)
- c) Suppose 2D and 3D finite element analysis were both conducted, which one would give more accurate results? Why? Is this always true for any cases? (15%)
- d) Please convert the subgrade k into metric unit, and calculate the radius of relative stiffness. (25%)



II-2. Please list and describe the major backcalculation methodologies for subgrade stiffness with FWD tests. (30%)

Part III

Please translate the following paragraphs into Chinese, and briefly elaborate your thoughts on each paragraph. (50 points for each Question)

- III①. Scientific research offers many other satisfactions in addition to the exhilaration of discovery. Researchers have the opportunity to associate with colleagues who have made important contributions to human knowledge, with peers who think deeply and care passionately about subjects of common interest, and with students who can be counted on to challenge assumptions. With many important developments occurring in areas where disciplines overlap, scientists have many opportunities to work with different people, explore new fields, and broaden their expertise. Researchers often have considerable freedom both in choosing what to investigate and in deciding how to organize their professional and personal lives. They are part of a community based on ideals of trust and freedom, where hard work and achievement are recognized as deserving the highest rewards. And their work can have a direct and immediate impact on society, which ensures that the public will have an interest in the findings and implications of research.
- III②. The object of research is to extend human knowledge of the physical, biological, or social world beyond what is already known. But an individual's knowledge properly enters the domain of science only after it is presented to others in such a fashion that they can independently judge its validity. This process occurs in many different ways. Researchers talk to their colleagues and supervisors in laboratories, in hallways, and over the telephone. They trade data and speculations over computer networks. They give presentations at seminars and conferences. They write up their results and send them to scientific journals, which in turn send the papers to be scrutinized by reviewers. After a paper is published or a finding is presented, it is judged by other scientists in the context of what they already know from other sources. Throughout this continuum of discussion and deliberation the ideas of individuals are collectively judged, sorted, and selectively incorporated into the consensual but ever evolving scientific worldview. In the process, individual knowledge is gradually converted into generally accepted knowledge.

1. Please answer the following questions regarding elastic moduli. (25%)

(a) For isotropic and homogeneous materials, one can define Young's modulus (E), shear modulus (G), Poisson's ratio (ν) and bulk modulus (K). Please find relationships among the 4 material properties. Specifically, please complete the following table. Note in each blank please write down an equation that connects the three material properties indicated in the leftmost column and topmost row. For example, in the blank in the upper left corner, please write down the equation relating G , E and ν . Points will be given when significant derivations are shown. In other words, show all your derivations.

	E, ν	G, ν	E, G	K, ν
G		G	G	
K				K
E	E		E	
ν	ν	ν		ν

(b) Regarding the relationships in (a), are these relationships valid, or not, if the materials are nonhomogeneous?

(c) For incompressible materials, what constraints do we need to put on the material properties? How many independent material properties do we need to describe an isotropic, homogeneous and incompressible solid?

2. Please answer the following questions regarding stress and beam bending problem.

(25%)

- (a) Please derive the relationship between normal stress and moment, and the relationship between shear stress and shear force in two-dimensional beams. Write down all the assumptions that you adopt.
- (b) Continuing (a), please derive the governing equation of the beam bending problem in terms of displacement. Write down all the assumptions that you adopt.
- (c) Given a three-dimensional stress state, as follows, found after solving a 3D beam bending problem.

$$\sigma = \begin{bmatrix} 5 & 12 & -15 \\ 12 & 8 & 3 \\ -15 & 3 & -2 \end{bmatrix}$$

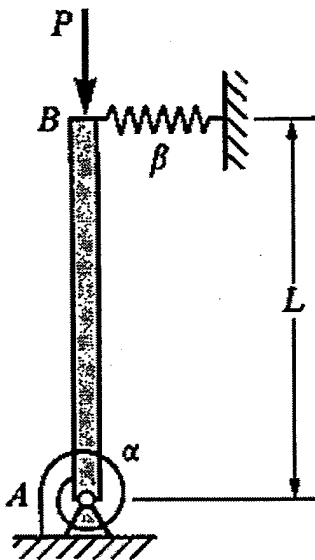
Please determine the principle stresses and corresponding principle directions. Also, please determine the orientation of the stress element that corresponds maximum shear stresses. What are the maximum shear stresses?

3. Please answer the following questions regarding buckling. (25%)

(a) Assume AB rod is rigid, please find the critical load (P_{cr}) to make buckling happen.

(b) Assume AB is a Euler column, please find the critical load (P_{cr}) to make buckling happen. Discuss the effects of α .

(c) What are similarities or dissimilarities in (a) and (b)?



4. Please answer the following questions regarding a static indeterminate problem. (25%)

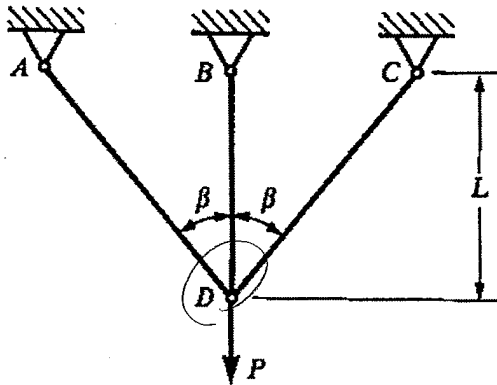
(a) Assuming the three rods are two-force members and they have the same Young's modulus (E) and cross-section area (A), please determine the internal forces in each of the rods by an energy method. Assume the displacement at point D along the loading direction is δ .

(b) Following (a), please re-solve the internal forces in the rods by the Force Method.

(c) Please write down all the assumptions you made in (a) and (b). Are the assumptions for (a) and (b) the same?

(c) Now, assume the components are elastic-perfectly-plastic, and have the same yield stress (σ_y). Please determine the complete P - δ curve for the three-rod structure.

Determine the applied force (P_u) that would make the structure collapse.



第一題：35 分

事件背景：

人：營造廠施工領班：A(大學畢業，工作經驗半年)

營造廠工地主任：B(工作經驗 15 年)

連續壁專業承包商：C

事：台北市信義路上一地上 12 樓、地下 3 樓的住宅。開挖深度為 11m，原設計之連續壁長度為 23m。某晚連續壁施工作業中，溝溝坍塌嚴重，經多次清理，溝底依然有非常多的污泥。當鋼筋籠吊放後，發現還有 3m 露出地表。連續壁施工專業廠商 C，緊急找營造廠施工領班 A 會商，營造廠施工領班認為事情嚴重，不是自己可以處理或下決定，趕緊再找工地主任 B 至現場做決定。

本工程於開工之初即有延誤，故營造廠老闆答應建商要趕工，實在無法讓連續壁工程再重新施工。B 工地主任以其多年的實務經驗判斷，認為 20m(減少 3m)之連續壁對開挖施工沒有問題。而且鄰地施工一樣開挖 11m，連續壁設計採用 20m，一樣完工使用，沒有問題。所以工地主任指示將外露鋼筋籠切除，繼續趕工。

請簡述：

- (1) 首先，請就上述施工現象進行「事件分析」並說明可能導致之後果。
- (2) 其次，就分析結果提出工程管理上可以做為研究探討的「課題」。
- (3) 再其次，請就所提出的課題提出可行的「方案」來進行研究。
- (4) 最後，請預期研究成果會有什麼貢獻。

第二題：請說明下段文句的背景與意義。(35 分)

The Contractor shall give notice to the Engineer whenever the Works are likely to be delayed or disrupted if any necessary drawing or instruction is not issued to the Contractor within a particular time, which shall be reasonable. The notice shall include details of the necessary drawing or instruction, details of why and by when it should be issued, and details of the nature and amount of the delay or disruption likely to be suffered if it is late.

第三題：30 分

請研讀背面論文第一頁之後，回答下列問題。

1. 這篇論文的作者是哪些人？請寫出他們的姓。其中主要作者是哪一位？
2. 這篇論文發表於哪一份期刊？
3. 這篇論文發表於何時？
4. 這篇論文總共有幾頁？
5. 這篇論文一再提到 ERP。依據本論文，ERP 是什麼的縮寫？
6. 請以 100 字至 200 字大要說明本論文的內容。

Task-based modeling method for construction business process modeling and automation

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Accepted 29 October 2007

Abstract

Standardization and business process reengineering have assisted in achieving business process automation by introducing “best practices” as standard process models. However, they have also resulted in many problems because a standard model has limited flexibility to suit different practices of different customers. This drawback becomes even more significant for the construction industry which is dominated by non-standard practices. This article presents a Task-Based Modeling method (TBM) for modeling construction business processes. Key management tasks are defined as the basic task components. Supplementing each task with an execution method and detailed attributes, its action(s) can be fully defined and its outcome can be measured. A business process model can then be created to meet the need of the particular user by using the task components as the basic building blocks. A request-driven approach is also proposed to instantiate an instance of a process model and to kick-off the automated business process. A purchasing process is used as an example to illustrate the presented methodology.

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Keywords: Business automation; Process modeling; ERP; Workflow

1. Introduction

Business processes may deal with customers, business partners, and different departments across the entire company. Executing a process consumes time and resources (e.g., employee hours). Automating business processes has been recognized as an effective approach for improving business efficiency and productivity by reducing the time and/or resources [1]. Over the past decade, enterprise resource planning (ERP) has been one of the focuses with the promise to deliver the much needed solutions which can integrate various software applications into one distributed and heterogeneous environment [2,3]. ERP has been a fast growing business since 1990s. The world's largest ERP providers include SAP (<http://www.sap.com>) and Oracle (<http://www.oracle.com>).

Many ERP systems have been incorporated with Workflow Management Systems (WfMS) for enabling business process

automation to complement their data centric feature, to separate flow logic in an ERP system from its function logic, and to bring in the process centric feature of WfMS [4–8]. According to the Workflow Management Coalition [9], a workflow is a computerized facilitation or automation of a business process, in whole or part. The workflow of a business process is represented by a network consisted of tasks (e.g., activities) and transactions (e.g., flows) between tasks. Executing the network is characterized by executing the tasks in the network by following the sequence given by dependencies and information flows between tasks (<http://www.wfmc.org>).

Workflow technology (WT) with its origin in Office Information System (OIS) has attracted attention for developing enterprise applications [10]. A Workflow Management System (WfMS) is a middleware and groupware system empowered by a workflow engine, which manages the flow of a process among participants according to the process definition consisting of a sequence of tasks [4,7]. A WfMS can define, execute, coordinate, and maintain business processes. It manifests its capability through distributed applications [6,11].

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