

Mechanics of Material

1. Find the deflection w , at any point in the length x , of a simply supported beam of length L which carries a vertical concentrated force P at a distance c from the end (see Figure 1).

(30%)

- (a) Use any one of the conventional method.
- (b) Use the Rayleigh-Ritz method and assume the deflected shape function

$$\text{as } w = \sum_{n=1,2,\dots}^{\infty} a_n \sin(n\pi x / L).$$

- (c) Compare the deflection obtained by the conventional method and the Rayleigh-Ritz method at $x = c = L/2$.

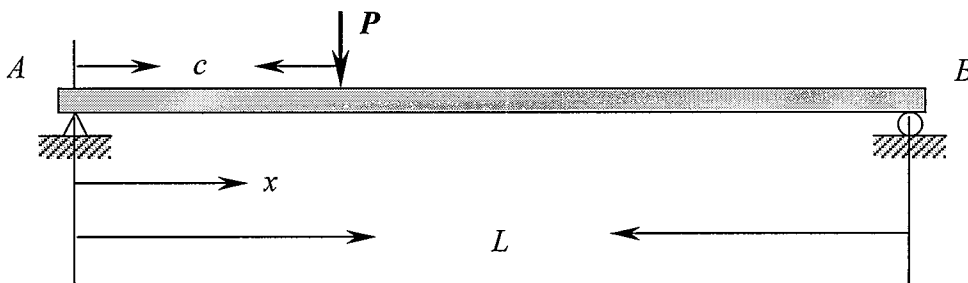


Fig. 1.

2. Determine the core of the following cross sections

(30%)

- (a) a circular ring section with outer radius $R_o = 10 \text{ cm}$ and inner radius $R_i = 8 \text{ cm}$
- (b) a square cross section with the side length $a = 10 \text{ cm}$
- (c) an equilateral triangle cross section with the side length $a = 10 \text{ cm}$

[Hint: The region in which the compressive load may be applied without producing any tensile stress on the cross section is called the core of the cross section.]

3. A column AB having a hinge support at A and a sliding support at B is subjected to axial force P at both ends. (i) Derive the differential equation in terms of the deflection curve $v(x)$ for the beam. (ii) Solve the differential equation to obtain the critical buckling load P_{cr} and the critical buckling mode shape. (iii) What is the effective length factor K for the column?

(40%)

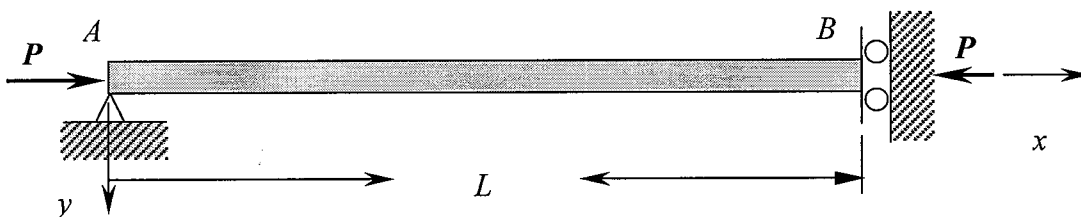


Fig. 2.

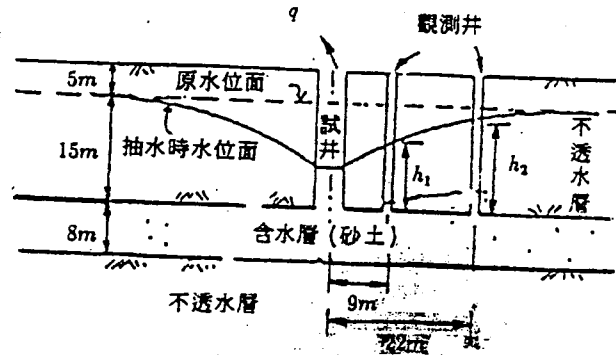
1. (a). 請說明 RMR (Rock Mass Rating) 之內容及應用情形。
- (b). 請說明如何求得具有節理面的岩石試件之破壞準則 (Failure Criterion)

2. 有一岩盤具有二組節理面 A, B, 其位態如下表所示:

節理	走向	傾斜
A	N10°E	40°NW
B	N80°W	40°SW

- ① 請繪出此二組節理的下半球投影, 並繪出極點。
- ② 此二組節理所構成之楔型岩塊, 若產生滑動, 其滑動方向為何?

3. 有一砂土層其上下層均為不透水層，砂土層厚為 8m(參見下圖)，今進行抽水試驗，求得流量 $q=0.6\text{m}^3/\text{min}$ ，由抽水試井附近二處觀測井之水位知 $h_1=10\text{m}$ ， $h_2=14\text{m}$ 。試推導求取滲透係數(coefficient of permeability)之公式，並求砂土層之滲透係數。試估算砂土之有效粒徑(effective grain size)。



4. 飽和黏土層內之一點，其總垂直應力為 180kN/m^2 ，總水平應力為 130kN/m^2 ，作用於該點之孔隙水壓力為 40kN/m^2 ，Skempton 孔隙水壓力參數 A 為 0.6。
- (1) 若土樣自地層取出，則垂直與水平應力減小為零，試求試樣內部所產生之孔隙水壓力變化。
 - (2) 利用此試樣進行圍壓分別為 100kN/m^2 ， 200kN/m^2 與 300kN/m^2 之飽和壓密排水三軸試驗，假設第一次試驗求得之有效應力相關之強度參數為 $c'=18\text{kN/m}^2$ 與 $\phi'=23^\circ$ ，試問若將此土樣進行飽和不壓密排水三軸試驗，其與總應力相關之剪力強度參數 c 與 ϕ 為何？請說明理由。
5. 試就深、淺基礎之設計分析、邊坡穩定分析或擋土結構之設計分析，寫出五種安全係數之表示方式。為何吾人對於各種安全係數認定為合格之數值各有不同，試說明之。
6. 試說明吾人於各類型基礎相關設計分析所需使用到的設計參數，如何求得？

7. 何謂土壤顆粒分佈曲線及阿太堡限度？試說明其如何應用於土壤工程分類？
8. 試說明土壤之三軸壓縮試驗為何有不壓密快剪、壓密快剪及壓密慢剪試驗之區分？必要時，請舉例說明之。
9. 欲於沖積層（Alluvial deposit）上方建造公路路堤（Embankment）時可能發生何種問題？可採用何種工法解決？概述其原理及設計方法。
10. 詳述現行之土壤構造物（如擋土牆）之耐震設計方法？經過 921 大地震，你發現現行之耐震設計法有何缺點？有缺點的話，請你設計一個可行的研究計畫以改進現行之耐震設計。
11. 試擬定約 50 公頃坡地，欲開發為新居住社區之工址調查計劃，包括各種調查項目、目的與執行方式或方法（例如：鑽探孔配置，現地試驗，取樣計劃，土壤或岩石力學試驗，土壤分析以及基礎分析等）。
12. 試論台灣中央山脈之隧道工程與台北盆地之隧道工程，工程地質調查項目與方法，各有那些特點或者有何不同？各自在施工過程中可能發生什麼地質災變？如何避免災變？或者萬一發生災變如何克服？

The National Cheng Kung University
Department of Civil Engineering
Highway Engineering
Entrance Examination for Ph.D. Students
1 June, 2001

Please translate the following paragraphs into Chinese. You could earn extra points if you would be able to elaborate the contents.

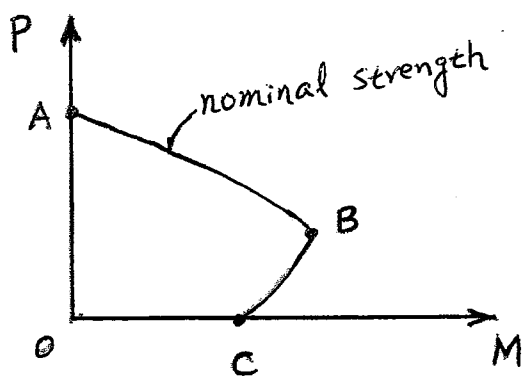
1. While passenger and commercial travel on our highways has increased dramatically in the past 10 years, America has been seriously under-investing in needed road and bridge repairs, and has failed to even maintain the substandard conditions we currently have. This is a dangerous trend that is affecting highway safety, as well as the health of the American economy. Congress and state and local governments have begun to address the investment crisis and crumbling infrastructure through the enactment of the Transportation Equity Act for the 21st Century (TEA-21), which provided \$218 billion for the nation's highway and transit programs. TEA-21 funds, combined with additional revenues from state and local governments, have begun to make an impact on road projects in all 50 states. Total highway expenditures by all levels of government and all expenditure types (including capital outlays; maintenance; and research, policing and administrative) have increased from \$93.5 billion in 1995, before TEA-21 was enacted, to \$111.9 billion in 1999. Additionally, the obligation of federal funds for roadway projects has almost doubled during this same period from \$8.6 billion in 1995 to \$16.3 billion in 1999. Another good measure of the increased attention to our nation's highways is the miles of federal-aid roadway projects underway. This number has also increased dramatically from 16,654 miles in 1995 to 29,030 miles in 1999. (50 points)
2. The classification of highways into different operational systems, functional classes, or geometric types is necessary for communication among engineers, administrator, and the general public. Different classification schemes have been applied for different purposes in different rural and urban regions. Functional classification, the grouping of highway by the character of service they provide, is developed for transportation design and planning purposes. Each highway category places on the functions of providing "mobility" (i.e., continuous travel) on one hand and "accessibility" (i.e., direct access to abutting properties) on the other. Local streets are predominantly designed for accessibility rather than mobility, whereas high-level facilities such as freeways are predominantly designed for high-speed continuous movement. Functional classification groups streets and highways according to the character of service they are intended to provide. This classification scheme recognizes that most travel involves movement through networks of roads and can be categorized relative to such networks in a logical and efficient manner. A typical functionally classified network consists of three types of roadways: arterials, collectors, and local roads. (50 points)

路面材料

1. 於土木工程中，訂定材料規範之目的。(30分)
- 2 瀝青混凝土配合設計中，夯壓程度及方式之影響為何？(30分)
3. 於路面材料研究領域中，試驗室實驗及道路試驗在此領域所扮演之角色為何？(40分)

一、

(1) 根據下圖所示柱斷面之 P-M 互制關係曲線，試列式說明如何求解 A 點、B 點及 C 點之最大軸力及彎矩之組合值。 (15%)



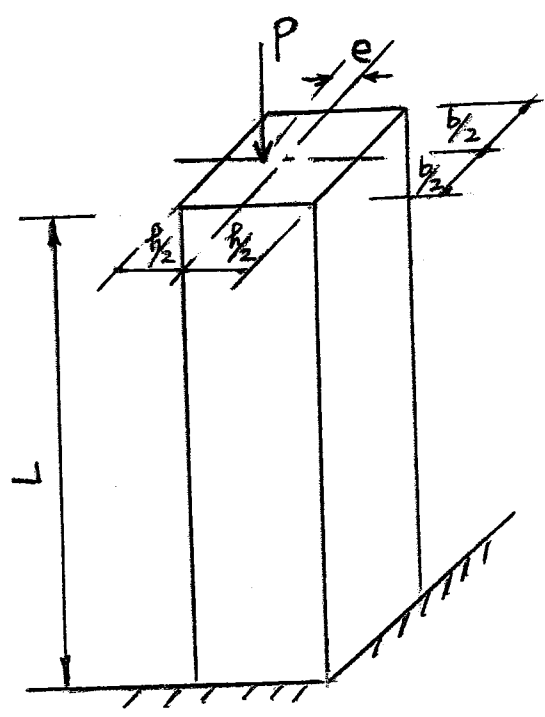
(2) 當偏心距 e 固定，柱長 L 愈來愈大時，試繪 P-M 之關係曲線示意圖，並扼要說明其原因。 (10%)

二、

當柱斷面所承受之軸力大小如以下情況，試列式說明如何推算此柱斷面所對應之曲率韌性 (curvature ductility)。

(1) $P=0$ (15%)

(2) $P=0.2P_0$ (10%)



成大土木系丁組博士班入學考試

3. 試述鋼纖維添加量對混凝土材料楊氏模數、抗拉強度及破裂韌性之影響為何？
4. 試述交聯密度 (Cross-link Density) 對高分子材料楊氏模數、抗拉強度及抗老化性之影響為何？

成功大學土木系

九十年度博士班營建管理試題

一. 請用中文簡述下列句子，不必逐句翻譯，但須將內容表達清楚：(30%)

1. The Contractor shall, on the instructions of the Engineer, suspend the process of the Works or any part thereof for such time and in such manner as the Engineer may consider necessary and shall, during such suspension, properly protect and secure the Works or such part thereof so far as necessary in the opinion of the Engineer. Unless such suspension is:
 - a. otherwise provided for in the Contract,
 - b. necessary by reason of some default of or breach of contract by the Contractor or for which he is responsible,
 - c. necessary by reason of climatic conditions on the Site, or
 - d. necessary for the proper execution of the Works or for the safety of the Works or any part thereof.

2. Construction operations contain the basic work processes in construction. Their definition requires the knowledge of the construction technology involved, a break down of the processes into element work tasks, the identification of the required resources, and the definition of the work assignment to the labor force involved. The description of a construction operation must indicate what is to be done and how (i.e., the technology focus) and who is to do it with what (i.e., resource use focus). Practical description for the performance of the construction operation must also indicate the conditions under which the various processes and work tasks can be initiated, interrupted, or terminated. The planning and management of an efficient construction operation also requires information relating to the impact on productivity and resource use of different spreads of requirement for different crew composition and sizes.

二. 現有一專案之工程進度較其原先計畫落後 50%，若妳（你）是此工程之專案經理，將如何處理此一問題，詳細敘述妳（你）的考量因素、施行步驟及決策過程？(25%)

三. 請試就營造業的產業特性及妳（你）對現有資訊科技的瞭解，討論應如何建立營建管理資訊系統（CMIS）？(25%)

四. 營造業正面臨景氣低迷、餘屋過多等不利因素的衝擊，加上現今以知識價值為主的經濟型態，營造商勢必要改變其企業體質，提升企業本身的知識價值，請試說明知識管理對營造產業的影響及應如何落實？(20%)