

注意：考試開始鈴響前，不得翻閱試題，
並不得書寫、畫記、作答。


國立清華大學 113 學年度碩士班考試入學試題

系所班組別：動力機械工程學系
丙組(固體與奈微米力學組)

科目代碼：1301

考試科目：材料力學

—作答注意事項—

1. 請核對答案卷(卡)上之准考證號、科目名稱是否正確。
2. 考試開始後，請於作答前先翻閱整份試題，是否有污損或試題印刷不清，得舉手請監試人員處理，但不得要求解釋題意。
3. 考生限在答案卷上標記「由此開始作答」區內作答，且不可書寫姓名、准考證號或與作答無關之其他文字或符號。
4. 答案卷用盡不得要求加頁。
5. 答案卷可用任何書寫工具作答，惟為方便閱卷辨識，請儘量使用藍色或黑色書寫；答案卡限用 2B 鉛筆畫記；如畫記不清(含未依範例畫記)致光學閱讀機無法辨識答案者，其後果一律由考生自行負責。
6. 其他應考規則、違規處理及扣分方式，請自行詳閱准考證明上「國立清華大學試場規則及違規處理辦法」，無法因本試題封面作答注意事項中未列明而稱未知悉。

國立清華大學 113 學年度碩士班考試入學試題

系所班組別：動力機械工程學系碩士班 丙組(固體與奈微米力學組)

考試科目 (代碼)：材料力學(1301)

共 4 頁，第 1 頁

*請在【答案卷、卡】作答

1. (25%) As shown in the Figure 1, determine the maximum allowable intensity w of the distributed load that can be applied to member BC without causing member AB to buckle. Assume that AB is made of steel ($E_{st} = 200\text{GPa}$, $\sigma_Y = 360\text{ MPa}$) and is pinned at its ends for x - x axis buckling and fixed at its ends for y - y axis buckling. Use a factor of safety with respect to buckling of 3.

Note: member BC can be assumed rigid.

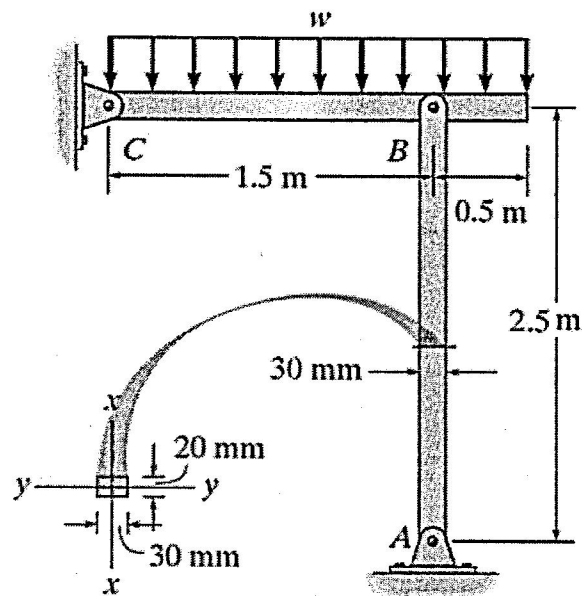


Figure 1

國立清華大學 113 學年度碩士班考試入學試題

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共_4_頁，第_2_頁

*請在【答案卷、卡】作答

2. (25%) As shown in the Figure 2, a cylindrical tank with closed ends contains compressed nitrogen gas at a gage pressure of $P = 20,000$ psi and is subjected to a compressive axial force $F = 70,000$ lb. The tank is with inner radius $r = 10$ in and thickness $t = 0.1$ in, and material property Young's modulus $E = 30 \times 10^6$ psi and Poisson's ratio $\nu = 0.3$. Answer the following questions:

- Obtain the normal stresses σ_x and σ_y of the stress element shown on the surface of the tank.
- Draw the Mohr circle of the given stress state.
- Determine the transformed stress state if the stress element is rotated 60° from the horizontal direction.
- Obtain the principal stresses and the maximum in-plane shear stress of the element.
- Obtain the absolute maximum shear stress of the element (assume plane stress condition).
- From the given stresses, determine the circumferential and the longitudinal strain.

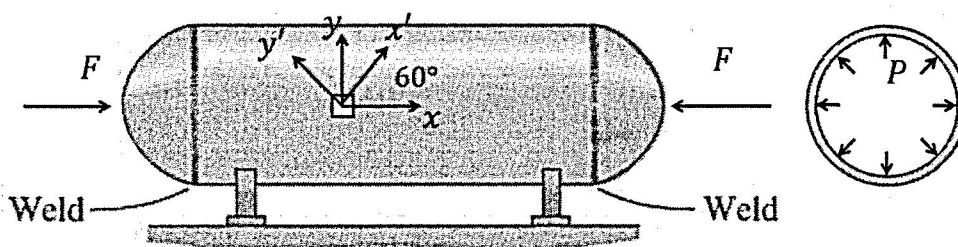


Figure 2

國立清華大學 113 學年度碩士班考試入學試題

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共 4 頁，第 3 頁

*請在【答案卷、卡】作答

3. (25%) As shown in Figure 3, the 20-kg drum is suspended from the hook mounted on the wooden frame. Determine the states of stress at points E and F on the cross sections of the frame at sections $a-a$ and $b-b$, respectively.

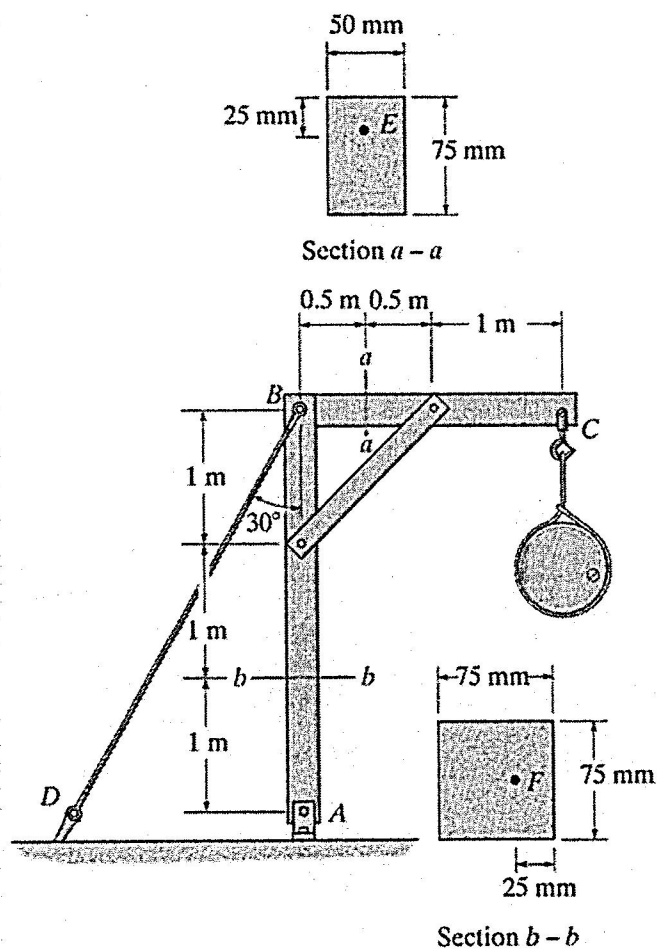


Figure 3

國立清華大學 113 學年度碩士班考試入學試題

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考試科目 (代碼)：材料力學(1301)

共_4_頁，第_4_頁

*請在【答案卷、卡】作答

4. (1) (15%) By using the moment-area method, determine the reactions at the supports shown in Figure 4.

(2) (10%) Draw the shear and moment diagrams.

Note: EI is constant. Support B is a thrust bearing.

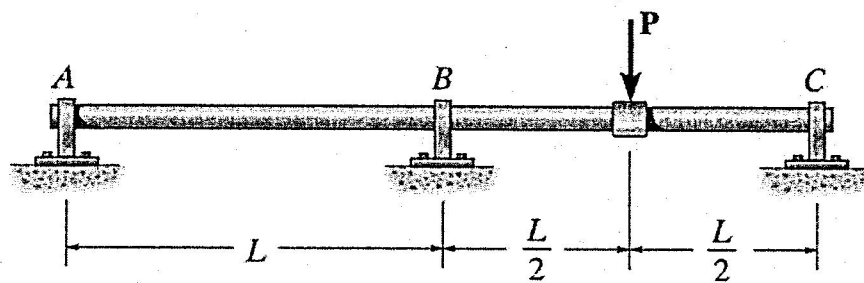


Figure 4