

國立中正大學
113 學年度碩士班招生考試
試題

[第 2 節]

科目名稱	材料力學
系所組別	機械工程學系-甲組

—作答注意事項—

※作答前請先核對「試題」、「試卷」與「准考證」之系所組別、科目名稱是否相符。

1. 預備鈴響時即可入場，但至考試開始鈴響前，不得翻閱試題，並不得書寫、畫記、作答。
2. 考試開始鈴響時，即可開始作答；考試結束鈴響畢，應即停止作答。
3. 入場後於考試開始 40 分鐘內不得離場。
4. 全部答題均須在試卷（答案卷）作答區內完成。
5. 試卷作答限用藍色或黑色筆（含鉛筆）書寫。
6. 試題須隨試卷繳還。

國立中正大學 113 學年度碩士班招生考試試題

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本科目共 2 頁 第 1 頁

系所組別：機械工程學系-甲組

1. (25%) Refer to Fig. 1, the beam supports the distributed load shown. Determine the resultant internal loadings acting on the cross section at point D. Assume the reactions at the supports A and B are vertical.

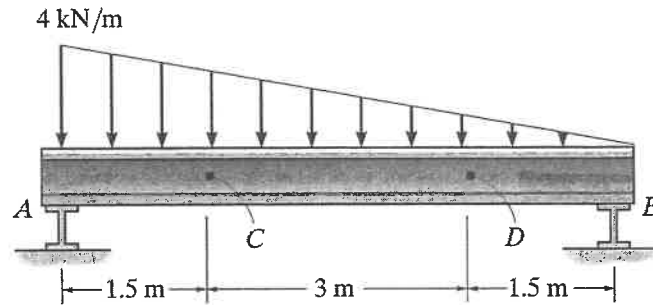


Fig. 1

2. (25%) Refer to Fig. 2, the two shafts are made of A-36 steel. Each has a diameter of 25 mm and they are connected using the gears fixed to their ends. Their other ends are attached to fixed supports at A and B. They are also supported by journal bearings at C and D, which allow free rotation of the shafts along their axes. If a torque of 500 N.m is applied to the gear at E as shown, determine the reactions at A and B, and determine the rotation of the gear at E. (The shear modulus of elasticity for the A-36 steel is $G_{steel} = 75 \text{ GPa}$.)

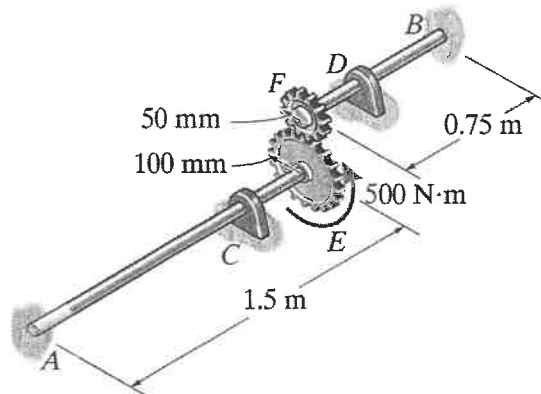


Fig. 2

3. (25%) A solid shaft has a radius of c subjected to a vertical force V as illustrated in Fig. 3. Derive an expression for the vertical component of shear stress acting on the horizontal plane through the shaft, (a) (15%) located a distance y from the neutral axis. (b) (10%) Find the maximum shear stress and its location.

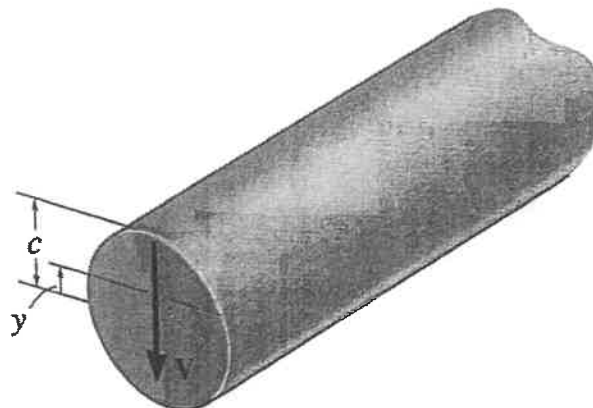


Fig. 3

國立中正大學 113 學年度碩士班招生考試試題

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本科目共 2 頁 第 2 頁

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4. (25%) The solid shaft is subjected to a torque, bending moment, and shear force as shown in Fig. 4. Determine (a) (7%) the normal stress, (b) (8%) the shear stress and (c) (10%) the principal stress acting on Point A.

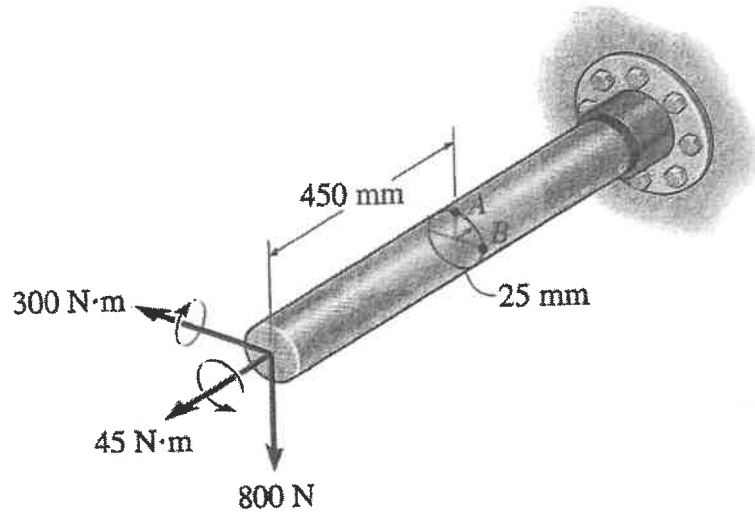


Fig. 4

Reference formula:

$$G = \frac{E}{2(1+\nu)}, \quad \delta = \frac{PL}{AE}, \quad \tau = \frac{T\rho}{J}, \quad \phi = \frac{TL}{JG}, \quad J = \frac{\pi}{2}c^4, \quad J = \frac{\pi}{2}(c_o^4 - c_i^4), \quad \sigma = -\frac{My}{I}, \quad I = \frac{1}{12}bh^3,$$

$$I = \sum(\bar{I} + Ad^2), \quad \bar{y} = \frac{\sum \tilde{y}A}{\sum A}, \quad \sigma = -\frac{M_z y}{I_z} + \frac{M_y z}{I_y}, \quad I = \frac{1}{4}\pi r^4, \quad \bar{y} = \frac{4r}{3\pi}$$