

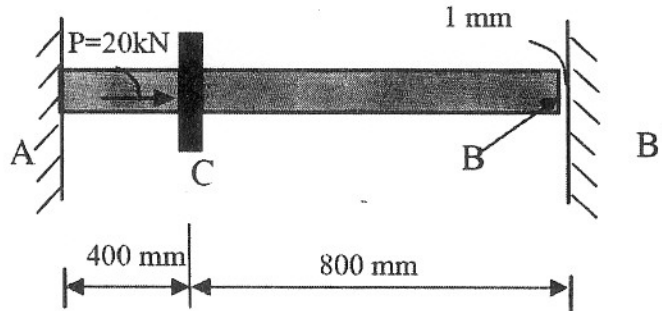
國立清華大學命題紙

96學年度 動力機械工程學系 系(所) 丙組(固體與奈微米力學組) 碩士班入學考試

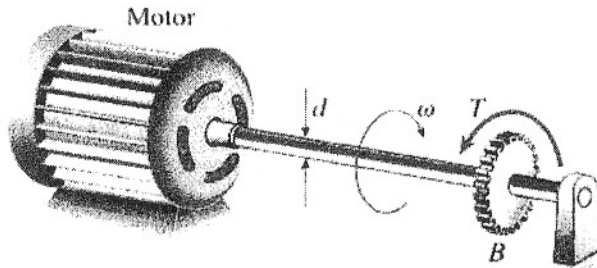
科目 材料力學 科目代碼 1201 共 2 頁第 1 頁 *請在【答案卷卡】內作答

不得使用電子計算器

1. The steel rod with $E=200$ GPa shown in Figure below has a diameter of 5 mm. It is attached to the fixed wall at A, and before it is loaded, there is a gap between the wall at B' and the rod of 1mm. Determine the reactions at A and B' if the rod is subjected to an axial force of $P = 20$ kN as shown. Neglect the size and the thickness of the collar at C. (20 points)



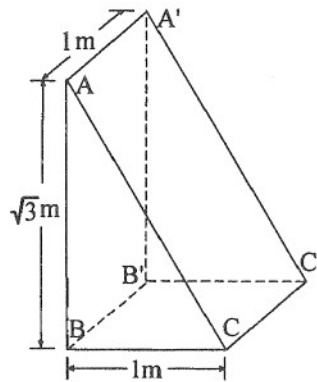
2. A motor driving a solid circular steel shaft transmits 30kW to a gear at B. The diameter of the shaft is 40 mm. (a) What is the torque T (N.m), (b) What is the maximum shear stress (τ_{max} , MPa), if the motor is operated at 500 rpm. (15 points)



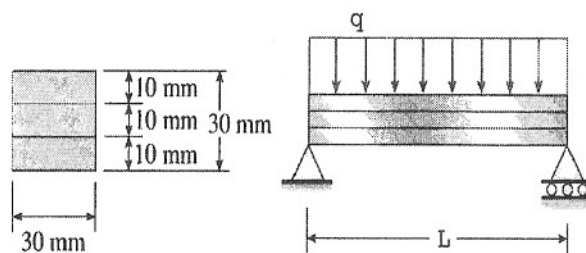
3. (a) A solid sphere of diameter 200 mm is subjected to an external pressure of 100 kPa. The sphere has modulus of elasticity $E = 1$ GPa and Poisson's ratio $\nu = 0.25$, find the change in diameter of the sphere. (b) A rubber ball is inflated to a pressure of 100 kPa. At that pressure the diameter is 200 mm and the wall thickness is 2 mm. The rubber has modulus of elasticity $E = 5$ MPa and Poisson's ratio $\nu = 0.5$. Determine the maximum stress and strain in the ball. (15 points)

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4. A right triangular block as shown in the figure has Young's modulus $E = 1.5 \text{ GPa}$ and shear modulus $G = 0.5 \text{ GPa}$. Uniform compressive stress 3 MPa is applied over the surface $AA'BB'$, whereas uniform compressive stress 1 MPa is applied over the surfaces $BB'C'C$. Both side faces ABC and $A'B'C'$ are smoothly constrained in a way that the block is in a state of plane strain. (a) Find the normal and shear stresses being applied over the inclined surface $AA'C'C$ for maintaining the equilibrium of the block, and (b) determine the reactive force on the surface ABC . (15 points)



5. A laminated beam of square cross section is built up by gluing together three strips, each $10 \text{ mm} \times 30 \text{ mm}$ in cross section (see figure). The beam carries a uniform load $q = 2 \text{ kN/m}$ and is simply supported with span length $L = 2 \text{ m}$. Calculate (a) the maximum bending stress σ_{\max} in the beam and (b) the shear stress in the glued joints. Neglect the weight of the beam. (15 points)



6. A clockwise moment M_0 acts at the mid-point of a fixed-end beam ACB of length L (see Figure). The flexural rigidity of the beam is EI . Find (a) all reactions of the beam and (b) the deflection curve for the left-hand half of the beam, $0 \leq x \leq (L/2)$. (20 points)

