

國 立 清 華 大 學 命 題 紙

九十三學年度 動力機械 系(所) 丙 組碩士班入學考試

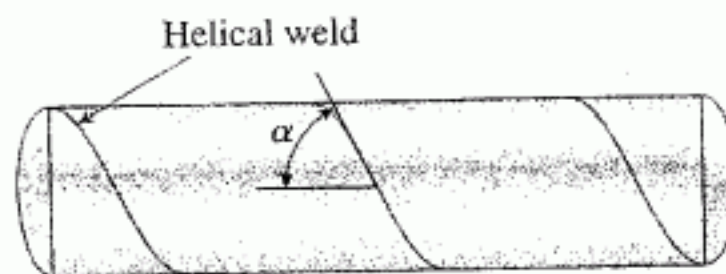
科目 材料力学 科號 1701 共 3 頁第 1 頁 \*請在試卷【答案卷】內作答

1. Give an explanation of the following terms. (15%)

- (a) Poisson's ratio
- (b) Yield stress
- (c) True strain

2. A steel tank is constructed with a helical weld that makes an angle  $\alpha = 60^\circ$  with the longitudinal axis. The vessel has inner radius  $r = 2$  m and wall thickness  $t = 25$  mm. The steel has Young's modulus  $E = 200$  GPa and Poisson's ratio  $\nu = 0.3$ . The internal pressure  $p$  is 600 kPa.

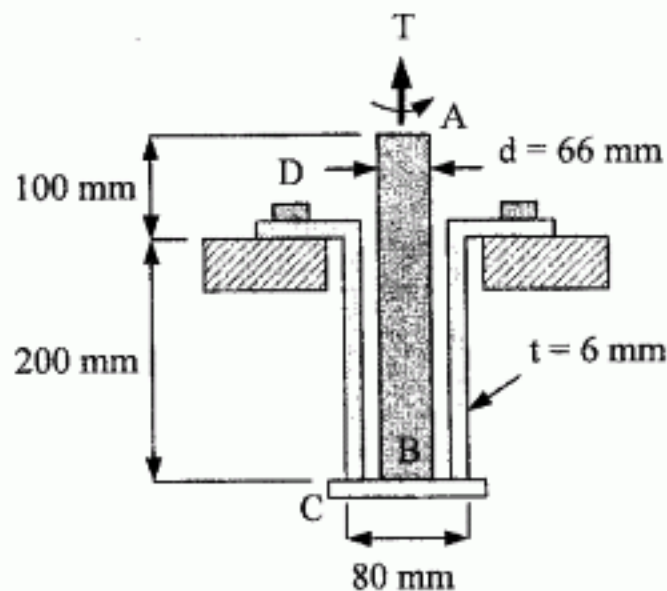
Determine the following quantities for the cylindrical part of the tank: (a) the circumferential and longitudinal stresses; (b) the circumferential and longitudinal strains; (c) the maximum in-plane and out-of-plane shear stresses; and (d) the normal and shear stresses acting on plane parallel to the welded seam. (20%)



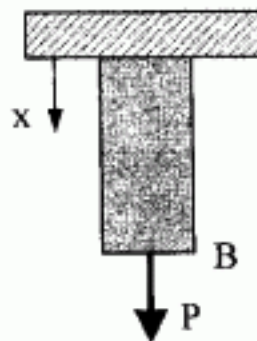
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3. The solid spindle AB of diameter  $d = 66$  mm passes through the sleeve CD and is welded to the sleeve at C. The sleeve has an outer diameter of 80 mm and a wall thickness of 6 mm. Knowing that the allowable shearing stress for both of the spindle and sleeve is 60 MPa, determine the largest torque  $T$  which may be applied. (20%)



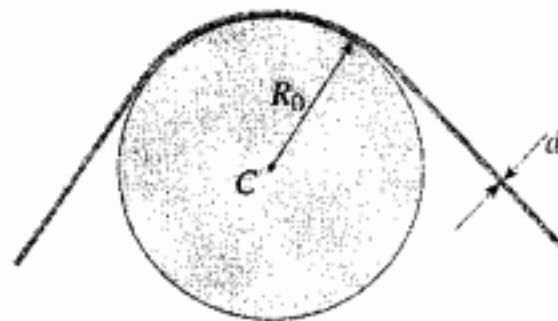
4. A prismatic bar (cross section area  $A$ , Length  $L$ , Young's modulus  $E$ , and specific weight  $\rho$ ) suspended from one end carries, in addition to its own weight, an axial load  $P$  was applied at end B. Determine the strain energy  $U$  stored in the bar. According to  $U$ , also find out the displacement at end B. (15%)



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5. A high-strength steel wire of diameter  $d = 4 \text{ mm}$  is bent around a cylindrical drum. The steel wire has modulus of elasticity  $E = 200 \text{ GPa}$  and maximum allowable stress  $\sigma_{\text{allow}} = 1200 \text{ MPa}$ . Determine the minimum radius of drum  $R_0$  and the corresponding bending moment  $M$ . (15%)



6. A cantilever beam  $AB$  of length  $2L$  has a fixed support at  $A$  and a spring support at  $B$ . The spring behaves in a linearly elastic manner with stiffness  $k$ . If a uniform load of intensity  $q$  acts on the beam, use the second-order differential equation of the deflection curve (the bending-moment equation) and the boundary conditions at both ends, to find the downward displacement  $\delta_B$  of end  $B$  of the beam. (15%)

