國立臺北科技大學九十八學年度碩士班招生考試

系所組別：3110 土木與防災研究所甲組

第一節　材料力學　試題

注意事項：

1. 本試題共五題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

一、A cubic box with sides of length a=75mm (see Fig. 1) is subjected to tri-axial stress. The Young's Modulus and the Poisson Ratio of the material are E=60 GPa and $\nu = 0.25$. The measured compressive strains $\varepsilon_x = -720\times10^{-6}$ and $\varepsilon_y = \varepsilon_z = -270\times10^{-6}$. Determine the following quantities: (1) the normal stresses σ_x, σ_y and σ_z (10%)

(2) the volume change ΔV of the box. (10%)

二、In Fig. 2, the horizontal bar is rigid. If all the vertical members are the ealsto-plastic material with yield stress σ_Y and yield strain ε_Y.

(1) Plot the force-displacement diagram at point A. (10%)

(2) Determine the stresses of all the vertical members and the vertical displacement at point A when $P = 1.4\sigma_Y A$. (10%)

(3) Determine the residual stresses of all the vertical members and the permanent displacement at point A after unloading of $P = 1.4\sigma_Y A$ in case (2). (10%)

三、As can be seen in Fig. 3, the bar has fixed supports at ends of A and B and is loaded by $2T_0$ and T_0 at points C and D, respectively. Determine the reactions of torque at points A and B. (10%)

四、Determine the position of the shear center of the thin-wall half circular section shown in Fig. 4. Knowing that the thickness is t. (20%)

五、Derive the critical load as well as the buckling mode of a uniform bar with fixed supports at both ends. Suppose that the bending rigidity EI of the bar is constant. (20%)

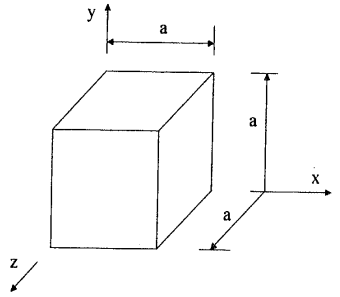

Fig. 1

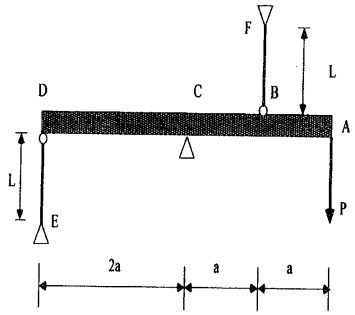

Fig. 2

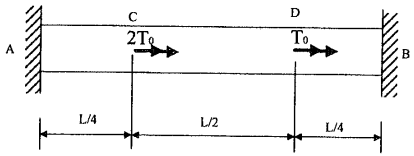

Fig. 3

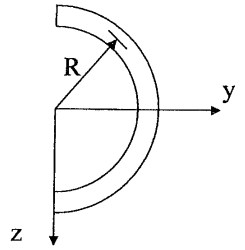

Fig. 4