

國立臺灣科技大學

九十四學年度碩士班招生考試試題

系所組別：機械工程系碩士班甲組、機械工程系碩士班乙組

科目：材料力學

總分 100 分，每題 25 分。

1. Determine the decrease in the volume of a solid steel sphere of 10 m in diameter submitted to a uniform hydrostatic pressure  $p = 10,000 \text{ N/m}^2$ . The Young modulus  $E$  and Poisson's ratio  $\nu$  of a solid steel are  $30 \times 10^6 \text{ N/m}^2$  and 0.3, respectively.
2. A prismatic bar of cross-sectional area  $A = 50 \text{ m}^2$  is subjected to axial compression by a force  $P = 10,000 \text{ N}$ . Find the normal stress  $\sigma_n$  and shear stress  $\sigma_s$  for a plane inclined at  $45^\circ$  to the axis of the bar.
3. A hollow circular shaft of the length of  $L$ , with the outer diameter of  $d_o$  and the inner diameter of  $d_i$ , is subjected to a torque  $T$ . The direction of the strain gage mounted on the outer surface is  $45^\circ$  from the longitudinal direction of the shaft. The shaft is made of an isotropic material with Young's modulus of  $E$  and Poisson's ratio of  $\nu$ . Derive the relationship between the applied torque  $T$  and the reading of the strain gage  $\epsilon$ .
4. A simple beam  $AB$  of the length of  $L$  supports two equal concentrated loads  $P$ , one acting downward and the other upward. The distance,  $a$ , from the downward load to the left end  $A$  is the same as that from the upward load to the right end  $B$ . And,  $a < L/2$ . Determine the deflection under the downward load.

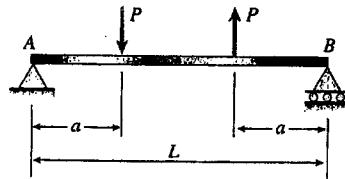


Fig. 4

19

