國立中央大學101學年度碩士班考試入學試題卷

所別：機械工程學系碩士班 甲組(固力與設計)(一般生)　科目：材料力學　共 1 頁 第 1 頁
機械工程學系光機電工程碩士班 乙組(光機)(一般生)
本科考試可使用計算器，廠牌、功能不拘

＊請在試卷答案卷（卡）內作答

1. As shown in **Fig. 1**, a solid circular shaft has a slight taper extending uniformly from one end to the other. Denote the radius at the small end by a, that at the large end by b. The radius at the larger end is 1.2 times that at the smaller end. If it is fixed at the larger end and is subjected to a torque T at the smaller end, determine the angle of twist of the smaller end for a given length L. What percentage of error is committed if this angle of twist is calculated using the mean radius of the shaft? The shear modulus is G. **(25%)**

2. For the beam shown in **Fig. 2**, determine the critical stresses and indicate the locations. (a) the maximum tensile and compressive bending stress; (b) the maximum shear stress resulting from transverse shear. **(25%)**

3. As shown in **Fig. 3**, the overhanging beam ABC has a flexural rigidity EI and length L. End C is attached to a spring of stiffness k. Determine the force in the spring due to the applied moment M_0. **(25%)**

4. As shown in **Fig. 4**, a circular shaft is fixed in the wall at A and a force F is applied at the end B. For $\theta = 90°$ and $\theta = 0°$, (a) determine the stress components (σ_{yy}, τ_{yx}, τ_{yz}) at points D and E; (b) draw a Mohr's circle to calculate the principal and maximum shear stresses at points D and E. (Points will be given **only if** using free body diagram to analyze the problem). **(25%)**

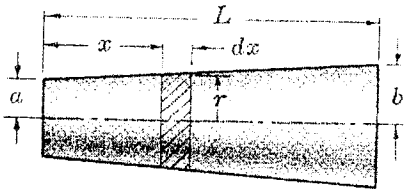
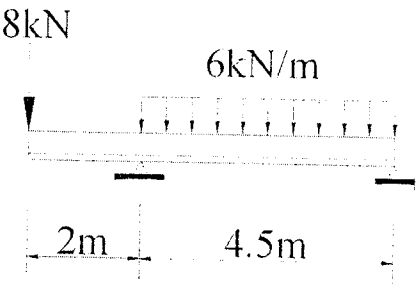
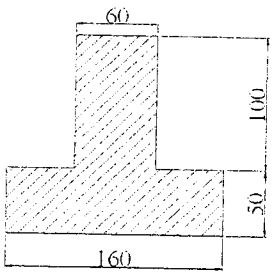


Fig. 1





cross-section view (unit: mm)

Fig. 2

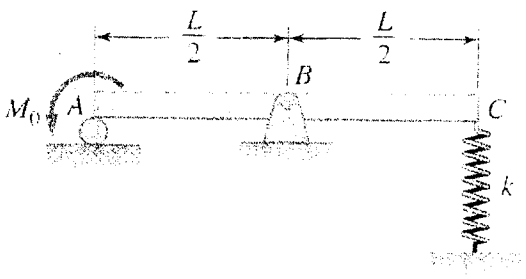


Fig. 3

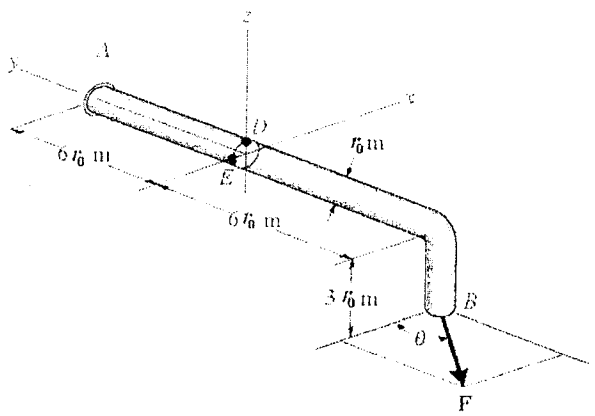


Fig. 4