1. (20 Points) A single strain gage is cemented to a solid 96-*mm*-diameter shaft at an angle $\beta = 20^\circ$ with a line parallel to the axis of the shaft as shown in Figure 1. Determine the torque **T** corresponding to a gage reading of 400μ. Use Young's modulus E = 35*GPa*, shear modulus G = 13.46*GPa*, and Poisson's ratio $\nu = 0.3$ for the shaft.

2. (20 Points) An uniform beam with the I-type cross-section shown in Figure 2(b) is subjected to the loading conditions illustrated in Figure 2(a). (i) Determine the distance a for which the maximum absolute value of the bending moment in the beam is as small as possible, and (ii) the corresponding maximum normal stress due to bending.

3. (20 Points) An aluminum rod ABC ($E = 10.1\times10^6 psi$), which consist of two cylindrical portions AB and BC, is replaced with a cylindrical steel rod DE ($E = 29\times10^6 psi$) of the same overall length. Determine the minimum required diameter d of the steel rod if its vertical deformation is not to exceed the deformation of the aluminum rod under the same load (28×10^3 pounds) and if the allowable stress in the steel rod is not to exceed $24\times10^3 psi$.

4. (20 Points) A solid circular shaft is loaded and supported as shown in Figure 4. If the tensile and shearing stresses at point A on the surface of the shaft are not to exceed 140*MPa* and 85*MPa*, respectively, determine the maximum value for the load R.

5. (20 Points) A circular shaft of the yield strength $\sigma_{yp} = 350MPa$ is subjected to a combined state of loading defined by bending moment M = $8\,kN\cdot m$ and torque T = $24\,kN\cdot m$ as shown in Figure 5. Calculate the minimum required shaft diameter to maintain the shaft to be within the elastic region. **Apply the maximum shearing stress theory.**

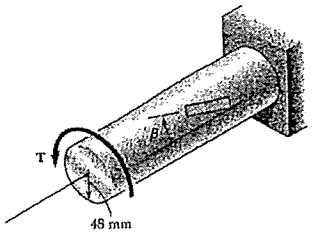

Figure 1

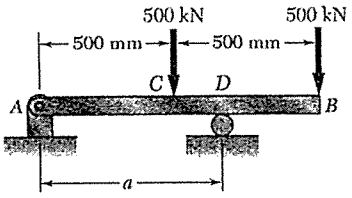

Figure 2(a)

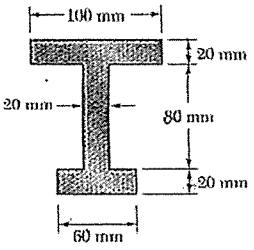

Figure 2(b)

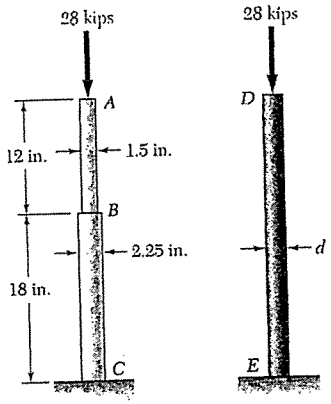

Figure 3

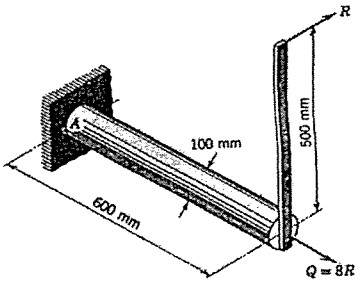

Figure 4

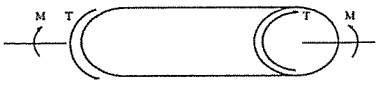

Figure 5

試題隨卷繳回