國立雲林科技大學
101 學年度碩士班暨碩士在職專班招生考試試題

系所：機械系
科目：材料力學

1. A simple beam AB with span length L=14 m supports a uniform load of intensity q that includes the weight of the beam (see Figure 1). The beam is constructed of three plates of the same thickness welded together to form the cross section shown in the figure.
   (1) Find the moment of inertia I of the cross section.
   (2) Determine the maximum permissible load q based upon:
      (a) an allowable bending stress σ_{allow}=110 MPa, and
      (b) an allowable shear stress τ_{allow}=50 MPa.

(25%)

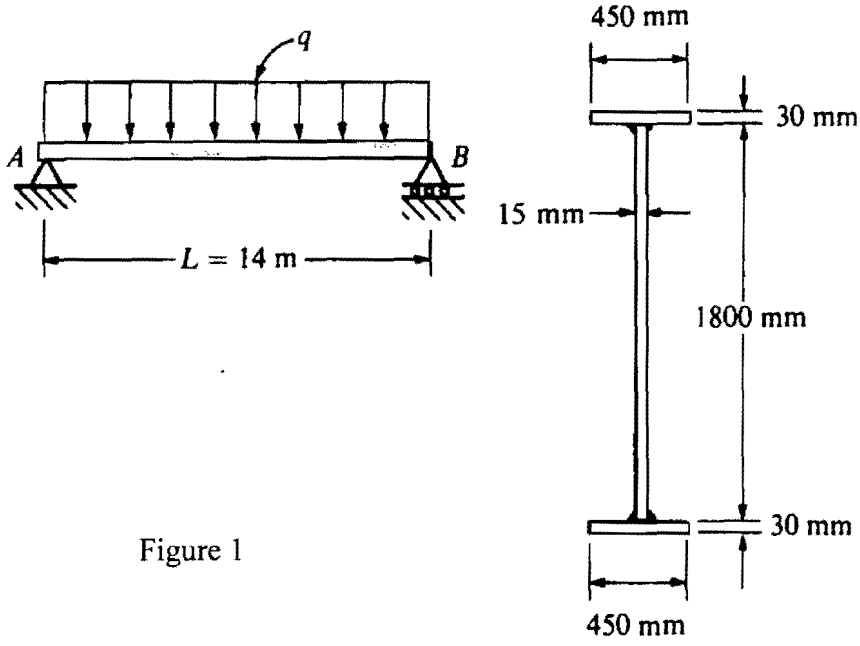

Figure 1

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2. A stepped shaft is subjected to three torques as shown in Figure 2. The left end of the stepped shaft is fixed on a wall. The length of each section is 0.5 m and the diameters are 80 mm, 60 mm, and 40 mm. The material is steel with shear modulus of elasticity G=80 GPa.
   (a) Find the reaction torque at the fixed end.
   (b) Calculate the maximum shear stress τ_{max} in the shaft.
   (c) Calculate the angle of twist φ (degrees) at the free end.

(25%)

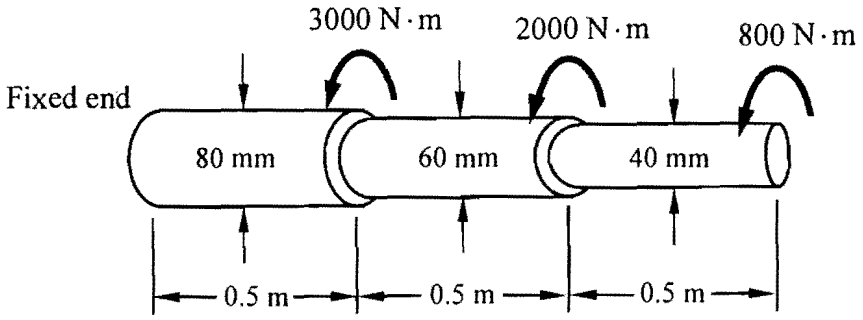

Figure 2

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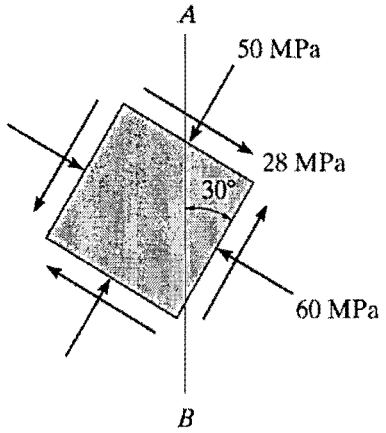
3. The state of stress at a point in a member is shown on the element. (a) Determine the stress components acting on the inclined plane *AB*. (b) Determine the principal stresses at the point and the orientation of the element upon which they act. (c) Determine the maximum in-plane shear stress and the corresponding average normal stress at the point. Also specify the orientation of the element upon which they act. [9%+8%+8%]



4. (a) Determine the equations of the elastic curve of the beam as shown and assume that *EI* is constant. (b) Determine the maximum deflection of the beam. (c) Determine the slope at the free end (the left end). [13%+6%+6%]