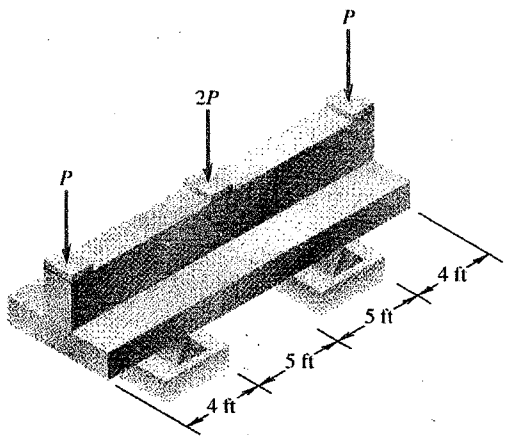
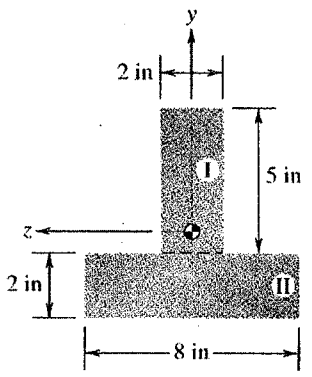
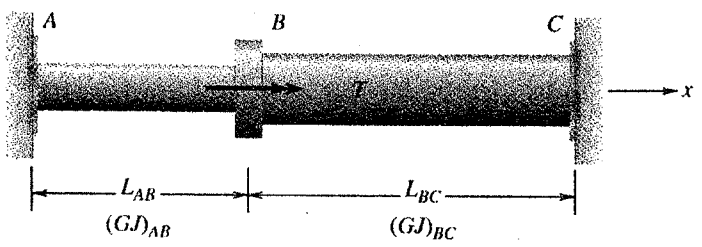
招生學年度	100	招生類別	碩士班
系所班別	材料科學與工程學系碩士班		
科目	材料力學		
注意事項	本考科可使用掌上型計算機		

1. A T-beam shown below is loaded by a set of three loads where $P = 2$ kips. (a) Draw the shear force and bending moment diagrams. (b) Determine the maximum value of the tensile and compressive normal stresses in the beam due to bending. (20%)

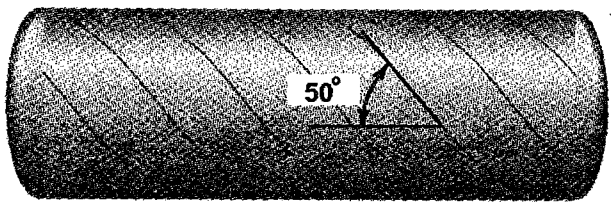




2. A twisting moment T is applied to a shaft ABC at section B. The material and the polar moment of inertial in segments AB and BC, i.e. $(GJ)_{AB}$ and $(GJ)_{BC}$, are different. Please determine the angle of twist at section B and the twisting moments in segments AB and BC. (20%)



3. A small, thin wall pressure vessel is fabricated from a segment of a spirally welded pipe with a spiral angle of 50° by welding rigid end plates to each end of the segment, as shown below. The inside diameter of the vessel is 250 mm, the wall thickness is 6 mm, and the internal gas pressure is 2 MPa. Please determine the normal stress perpendicular to the spiral weld and shear stress parallel to the spiral weld. (20%)



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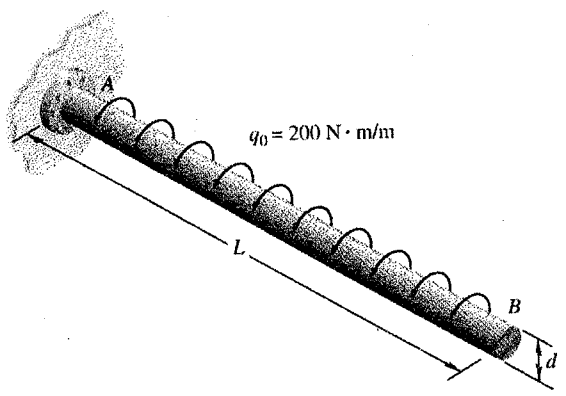
4. A steel shaft AB of diameter $d = 50$ mm is loaded by a distributed twisting moment $q_0 = 200$ N·m/m uniform along its length $L = 1.25$ m. Please determine (a) the twisting moment and angle-of-twist distribution along the shaft, and (b) the twisting moment at segment A and the twisting angle at segment B. Assume G = 80 GPa, and neglect the weight of the shaft. (20%)



5. Two steel pipes of nominal diameters 3 in (segment AB) and 2 in (segment BC) are joined end to end at B and constrained between rigid walls. Find the stress in each pipe and the displacement of joint B due to a temperature increase of $\Delta T = 100°F$. Use the values $E = 30{,}000$ ksi and $\alpha = 6.5 \times 10^{-6}/°F$; $A_{AB} = 2.23$ in^2, $A_{BC} = 1.07$ in^2. (20%)