ME-313 STRENGTH OF MATERIALS November 8, 2000

TEST II

OPEN TEXT BOOK

Name:_____
SS#: _____

1. The spherical pressure vessel in Figure 1 has an inner diameter of 2 m and a wall thickness of 10 mm. A strain gauge having an initial length of 20 mm is attached to the vessel and is observed to increase in length by 0.012 mm as the pressure in the vessel is increased. Determine the change in pressure causing this deformation. The vessel is made of steel for which E=200 GPa, and ν=0.3.

(15 pts.)

2. Each of the three traffic lights, shown in Figure 2, has a mass of 10 kg, and the pipe AB has a mass of 1.5 kg/m. Draw the shear force and bending moment diagrams for the pipe. Assume a cantilever support at B, and neglect the mass of the sign.

(25 pts.)

3. For the beam shown in Figure 3:
   a) Draw the free body diagram for the entire beam.
   b) Draw the shear force diagram.
   c) Draw the bending moment diagram.
   d) Determine the maximum axial stress due to bending.
   e) Using the left support of the beam as the origin for x, obtain an equation that represents the variation of M with x between D and E, i.e., for 2m<x<4m.

(30 pts.)

4. The thin walled pipe shown in Figure 4 has an inner diameter of 0.5 in. and a thickness of 0.025 in. It is subjected to an internal pressure of 500 psi, and axial tension and torsional loadings as shown.
   a) Determine the stresses due to each type of loading at a point on the surface.
   b) Draw a stress element representing the state of stress at the surface.
   c) Determine the principal stresses at the surface.
   d) Draw the Mohr's circle for the state of stress at the surface.

   (30 pts.)

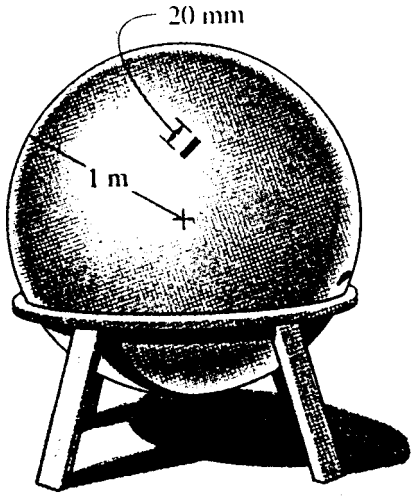


Figure 1

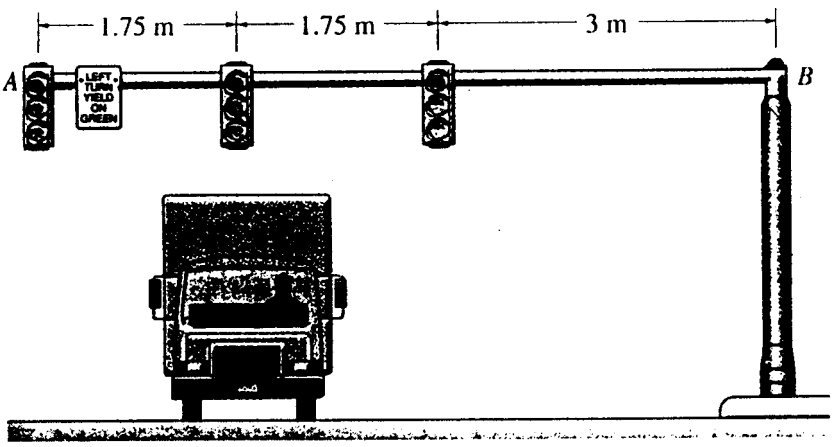


Figure 2

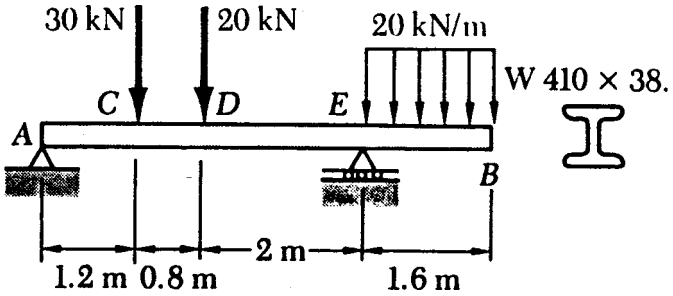


Figure 3

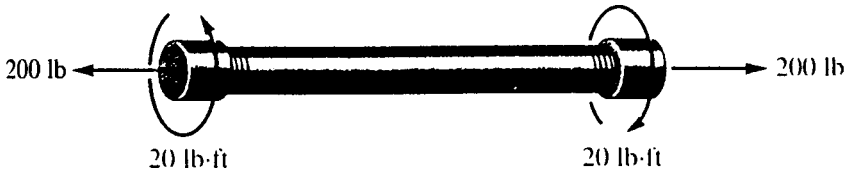


Figure 4