5/6 (1)

1. The roof of a long walkway is idealized as an infinitely long simply supported plate as shown in Fig. 1 On a rainy day, the roof starts collecting water due to bad drainage (排水不良). Find the minimum value of the plate bending rigidity D so that the plate does not collapse under the rain load. Disregard the weight of the plate itself.(15%)

Note : The equilibrium equation for an infinitely long plate reduces to

$$D\frac{d^4w}{dx^4} = g(x)$$

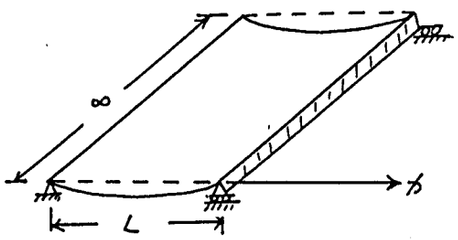

Fig. 1

2. Referring to Fig. 2. A simple beam with a initially uniform temperature To. The beam has its temperature change to T_1 on its upper surface and T_2 on its lower surface.

We assume that the variation in temperature is linear between the top and bottom of the beam. Disregard the weight of the beam itself.

(1) Find the deflection curve of this beam.(10%)

(2) If we assume P = 1 kip, L = 40 ft, a = 10 ft, b = 10 in, h = 20 in, T_1 = 50 °F, T_2 = 100°F, To = 75°F, Find the principal stress and maximum shear stress for point B. (15%)

$E = 30\times10^6$ psi, and $\alpha = 8.0\times10^{-6}$/°F.

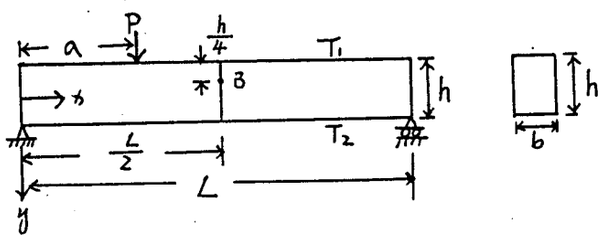

Fig. 2.

3. A bar of length L with weight W is initially pinned at end A and is connected to end C by a wire BC as shown in fig. A, if the bar is released from rest at $\theta = 60^{\circ}$ by cutting the wire BC, please determine the reaction at end A when the bar at the position of $\theta = 30^{\circ}$. (15%)

4. A ball A of mass 10 kg suspended from ceiling by a wire of length 1 m as shown in fig. B, is initially in horizontal position and released from rest to its lowest position to hit a block B of mass 15 kg which is connected to a spring with spring constant k = 90 N/m, whereas the coefficient of restitution between the ball and the block is e = 0.5. By assuming no frictions between all the contacting surfaces, please determine the maximum deformation of this spring. (15%)

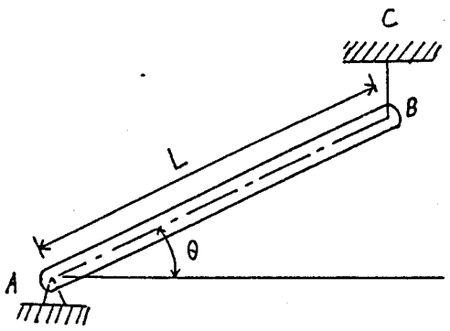

fig. A

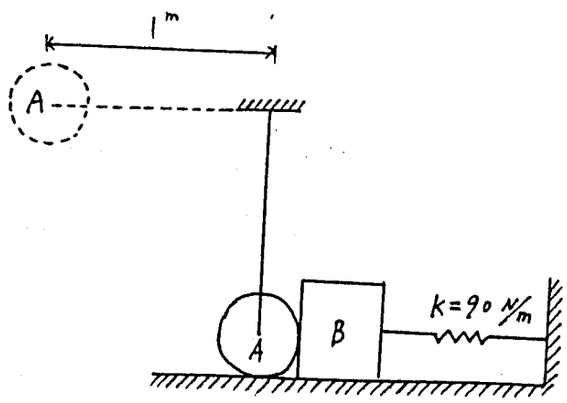

fig. B

5. A 180-N force is applied at corner B of a rigid piece of pipe ABDE as shown. The pipe is supported by the ball and socket joints A and E, respectively, and by a cable attached at the midpoint C of the portion BD and at a point G on the wall. Determine

1) the moment about point "A" due to the force W (5%)

2) the moment about axis AE due to the force W (10%)

3) the minimum tensile force (Tc) in the cable CG when the system is in equilibrium. (15%)