淡江大學 96 學年度碩士班招生考試試題

系別：機械與機電工程學系　　　　科目：材　料　力　學

1. (25%) A rod in Fig. 1(a) of a material having the stress-strain curve shown in Fig. 1(b) has a spring attached at one end.   The spring constant of this spring is 20,000 lb/in.   The rod has a cross-sectional area of 1.00 in^2 and is 20.0 inch long.   The load F is increased until the spring has elongated 0.75 inch and then decreased to zero.   Determine the closest length of the rod after the load is removed?   Hint: the elastic limit in Fig. 1(b) is 10,000 psi.
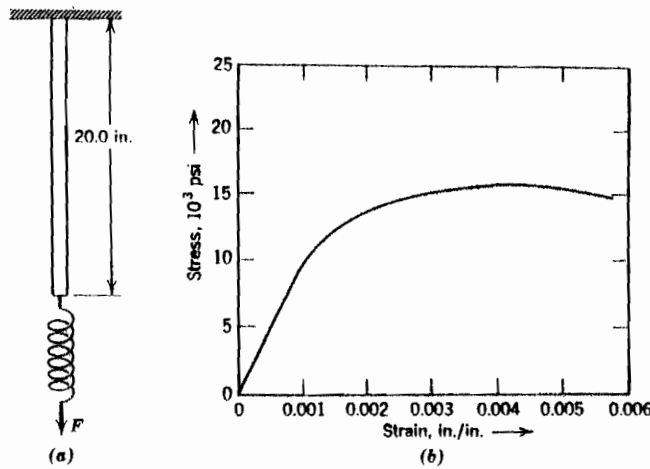

Fig. 1

2. (25%) A 3-m-long bar is supported at the left end B by a 6 mm diameter steel wire and at the right end C by a 10 mm diameter steel cylinder, as shown in Fig. 2.   The bar carries a mass m_{a1} = 200 kg and the mass of the bar itself m_{a2} = 50 kg.   Make a free-body diagram of the forces acting on the bar. Determine the resultant forces acting on the point B and C.   Determine the stresses in the wire and in the cylinder.
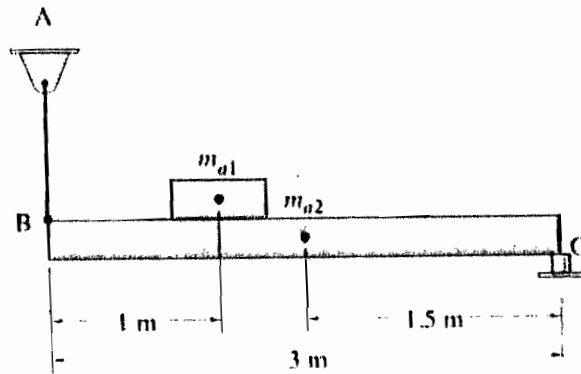

Fig. 2

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准帶項目請打「V」	
V	簡單型計算機

本試題共 2 頁

3. (25%) A shaft coupling (Fig. 3) is to be designed, using 1-inch diameter bolts at a distance of 6 inch from the center of the shaft.　Allowable shearing stress on the bolts is 15,000 psi.　If the shaft is to transmit 5800 *hp* at a speed of 1200 rpm, how many bolts are needed in the connection?
Hint: A coupling is a mechanical device for uniting or connecting two shafts.
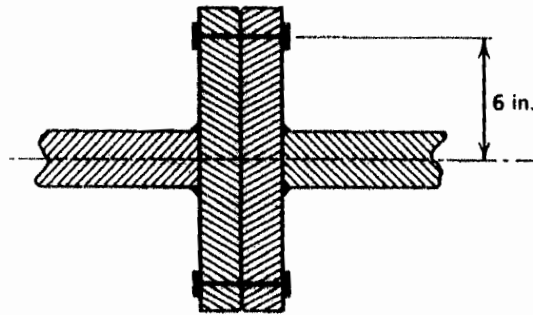1 *hp* = 33,000 ft-lb/min.　　$hp = T\varpi$

Fig. 3

4. (25%) The axle of an automobile subjected to the normal forces and a torque producing the state of stress shown in Fig. 4.　Determine the principal stresses and principal angles.　Show a sketch of the element oriented with principal stresses acting on it.

Hint:　$\sigma_x = \dfrac{\sigma_x + \sigma_y}{2} + \dfrac{\sigma_x - \sigma_y}{2}\cos 2\theta + \tau_{xy}\sin 2\theta$　　　　$\tan 2\theta_p = \dfrac{2\tau_{xy}}{\sigma_x - \sigma_y}$

$$\sigma_1, \sigma_2 = \frac{\sigma_x + \sigma_y}{2} \pm \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \left(\tau_{xy}\right)^2}$$
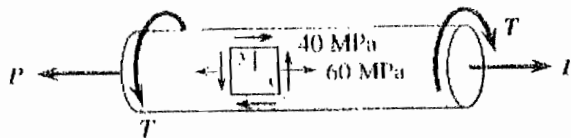

Fig. 4