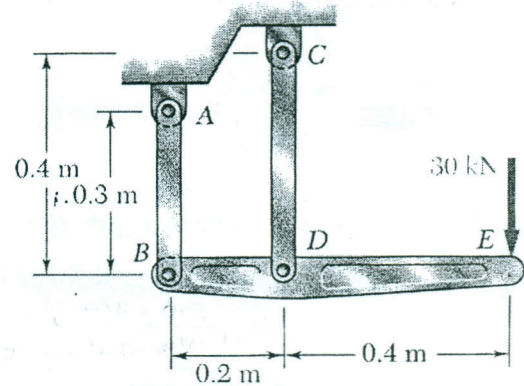




**Question One:** (15Marks)

as shown in Fig. 1. Link AB is made of aluminum ( $E = 70$  GPa) and has a cross-sectional area of  $500 \text{ mm}^2$ . Link CD is made of steel ( $E = 200$  GPa) and has a cross-sectional area of  $(600 \text{ mm}^2)$ . For the 30-kN force shown, determine the deflection **(a)** of B, **(b)** of D, and **(c)** of E.



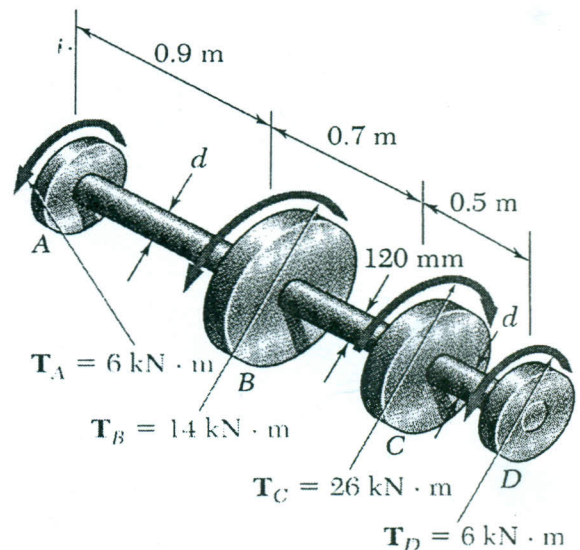
**Fig. 1**

**Question Two:** (20 Marks)

Shaft BC is hollow with inner and outer diameters of 90 mm and 120 mm, respectively. Shafts AB and CD are solid of diameter  $d$ . For the loading shown in Fig. 2,

**Determine:**

- (a) the minimum and maximum shearing stress in shaft BC,
- (b) the required diameter  $d$  of shafts AB and CD if the allowable shearing stress in these shafts is 65 MPa.



**Fig. 2**

**Question Three:**

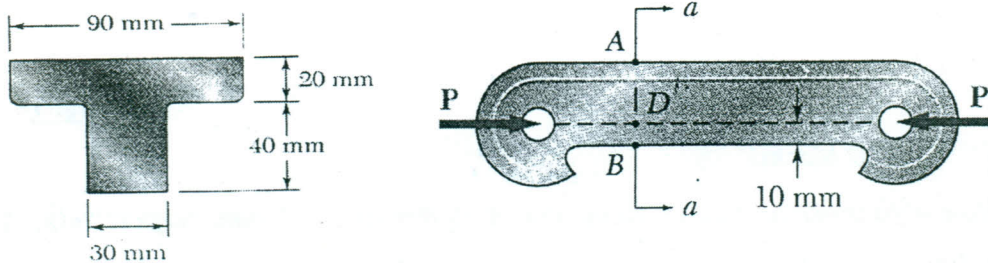
(15Marks)

A solid circular steel shaft is subjected to a twisting moment  $T = 1.50\pi$  KN.cm and a tensile force  $P$  of an unknown magnitude. If the outer diameter of the shaft is 2 cm and for steel the working normal stress and shear stress are  $120 \text{ N/mm}^2$  and  $50 \text{ N/mm}^2$  respectively, use Mohr's stress circle to find the maximum value of force  $P$ .

**Question Four:**

(25 Marks)

The largest allowable stresses for the cast iron link are 30 MPa in tension and 120 MPa in compression. Determine the largest force  $P$  which can be applied to the link shown in Fig. 3.



**Fig. 3**

Best Wishes  
Dr. Noha Fouda