COLLEGE OF ENGINEERING & TECHNOLOGY

Department : Mechanical Engineering
Lecturer : Staff
Course : Machine design 1
Course No. : ME 356 **Marks : 40**
Date : 11/1/2014 **Time : 2 Hours**

Final Examination Paper

Answer the Following Questions:

Question No. 1. [10 marks]

The bracket shown in Figure 1 is secured by 5 bolts. Find the minimum bolt diameter such that the shear stress in the bolts should not exceed 150 MPa. If the force F was acting vertically at point B "not A", do you think that the bolt diameter will increase or decrease?

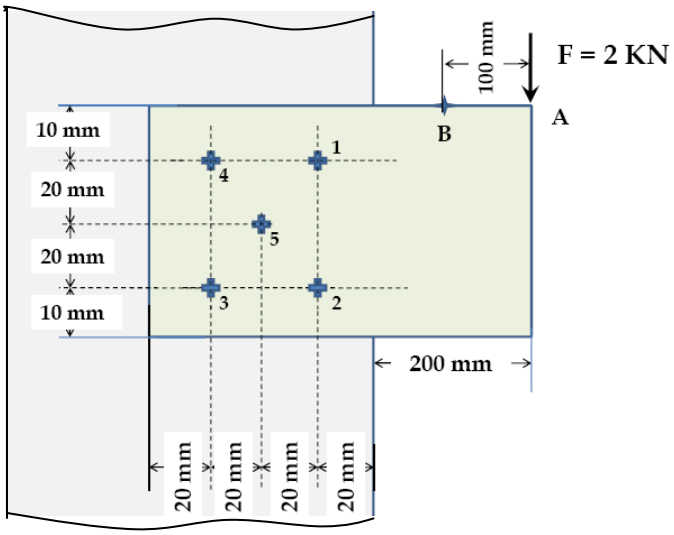


Figure 1

Question No. 2. [10 marks]

A vertical screw with single start square threads of 50 mm mean diameter and 12.5 mm pitch is raised against a load of 10 kN by means of a hand wheel, the boss of which is threaded to act as a nut. The axial load is taken up by a thrust collar which supports the wheel boss and has a mean diameter of 60 mm. The coefficient of friction is 0.15 for the screw and 0.18 for the collar. If the tangential force applied by each hand to the wheel is 100 N, determine:

a. Suitable diameter of the hand wheel.
b. Overall efficiency.
c. Whether the screw is overhauling.

Question No. 3. [10 marks]

The bolts were removed from the bracket shown in Figure 1 and we decided to weld it as shown in Figure 2. If the permissible shear stress is 120 MPa, do you think that the weld length is enough or we need to add another weld on the side CF.

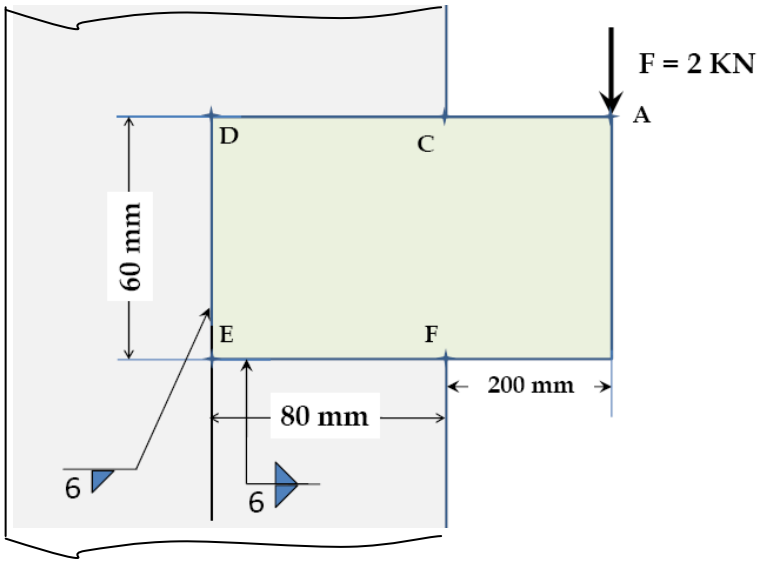


Figure 2

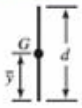
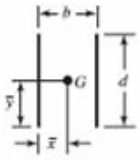
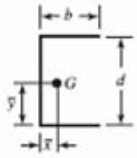
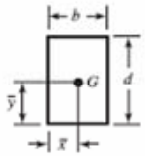
Question No. 4. [10 marks]

It is desired to design a plain compression spring considering the following:

- The maximum force, the spring can carry should not exceeds 620 N.
- The difference between the spring length when loaded with the maximum force and its free length is 30 mm.
- The spring index is 6.
- The wire material has an allowable shear stress of 570 MPa and modulus of rigidity of 70 GPa.

Determine:

a. Wire diameter;
b. Spring stiffness;
c. Total number of coils;
d. Solid length of spring; and
e. Free length of spring if the spring has a Pitch of 8 mm.

Weld	Throat Area	Location of G	Unit Second Polar Moment of Area
	$A = 0.70\,hd$	$\bar{x} = 0$ $\bar{y} = d/2$	$J_u = d^3/12$
	$A = 1.41\,hd$	$\bar{x} = b/2$ $\bar{y} = d/2$	$J_u = \frac{d(3b^2 + d^2)}{6}$
	$A = 0.707h(2b + d)$	$\bar{x} = \frac{b^2}{2b + d}$ $\bar{y} = d/2$	$J_u = \frac{8b^3 + 6bd^2 + d^3}{12} - \frac{b^4}{2b + d}$
	$A = 1.414h(b + d)$	$\bar{x} = b/2$ $\bar{y} = d/2$	$J_u = \frac{(b + d)^3}{6}$

Type of end	*Total number of turns (n')*	*Solid length*	*Free length*
1. Plain ends	n	$(n + 1)\,d$	$(p \times n) + d$
2. Ground ends	n	$n \times d$	$p \times n$
3. Squared ends	$n + 2$	$(n + 3)\,d$	$(p \times n) + 3d$
4. Squared and ground ends	$n + 2$	$(n + 2)\,d$	$(p \times n) + 2d$