GLASGOW CALEDONIAN UNIVERSITY

SCHOOL OF ENGINEERING & BUILT ENVIRONMENT

ENGINEERING DESIGN & ANALYSIS 2 (M2H721926): COMBINED BENDING AND DIRECT STRESS

Tutorial

1. A 50-mm diameter tie bar carries a pull of 80 kN offset at a distance of 3mm from the axis of the bar. Calculate the maximum and minimum of tensile stresses in the bar.

(21.25, 60.35 MN/m^2)

2. The cranked tie bar shown in Figure Q.2 carries a load of F kN. Calculate the maximum value of F if the tensile stress in section X-X is limited to 75 MN/m^2.

(90.3 kN)

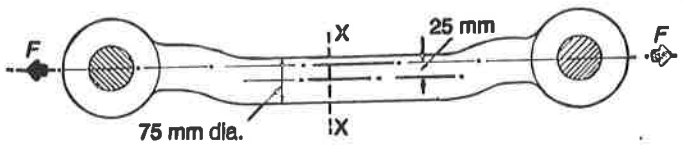

Figure Q.2

3. A short cast-iron column of rectangular section 50 mm x 30 mm carries a load of F kN as shown in Figure Q.3. Calculate the greatest value of F if the maximum *tensile* stress is limited to 15 MN/m^2.

(2.8 kN)

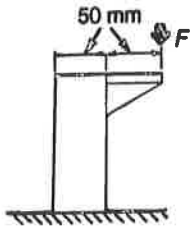

Figure Q.3

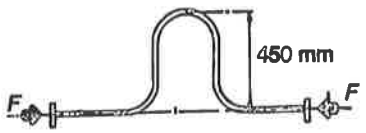

Figure Q.4

4. Figure Q.4 shows an expansion loop in a steam pipe. The pipe has an external diameter of 100 mm and internal diameter of 90 mm. If the end load F is 5 kN calculate the maximum tensile stress in the pipe.

(63.3 MN/m^2)

5. The aircraft undercarriage shown in Figure Q.5 is constructed of alloy tube. Calculate the maximum tensile and compressive stresses in the tube A if it is 50 mm outside diameter and 10 mm thick.

(416.2 MN/m^2 tensile, 480 MN/m^2 compressive)

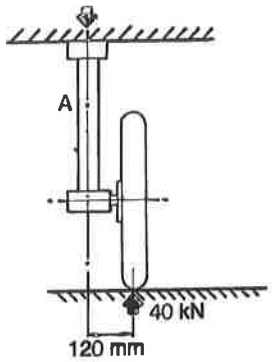

Figure Q.5

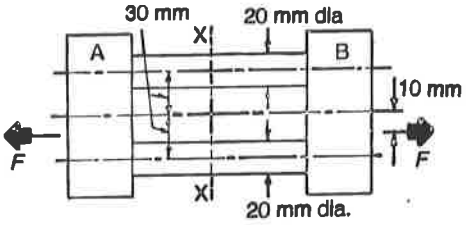

Figure Q.6

6. Two blocks A and B are connected by two short 20-mm diameter bars as shown in Figure Q.6. Calculate the maximum pull F at a distance of 10 mm from the axis of symmetry which may be exerted if the tensile stress at the section X-X is limited to 150 N/mm^2.

(65.8 kN)

7. Calculate the maximum force F which can be exerted in the press frame shown in Figure Q.7 if the tensile stress is limited to 100 N/mm^2. What is then the maximum compressive stress?

(1.13 MN; 50 MN/m^2)

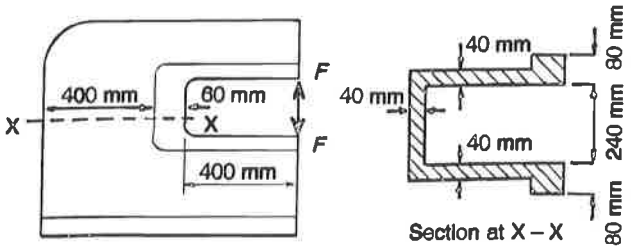

Figure Q.7

8. The pillar of the radial drill shown in Figure Q.8, is made of a hollow steel tube of 160 mm outside diameter and 120 mm inside diameter. Calculate the maximum tensile stress in the pillar

(22.35 MN/m^2)

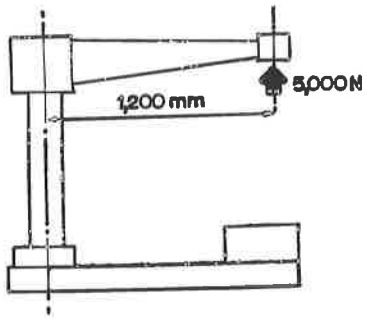

Figure Q.8

9. A steel chimney is 36 m high, 1.5 m external diameter, 20 mm thick. It is rigidly fixed at the base and is acted upon by a horizontal wind pressure of intensity 1.1 kN/m^2 of projected area. Calculate the maximum stress in the steel at the base if steel weighs 74 kN/m^2.

(34.1 MN/m^2)

10. The clamp shown in Figure Q.10 exerts a force of F N on the workpiece. If the section X-X is to carry a maximum tensile stress of 65 N/mm^2, find the maximum clamping force.

(2.77 kN; centroid of section is 11 mm from top face, I about centroid = 36,200 mm^4.)

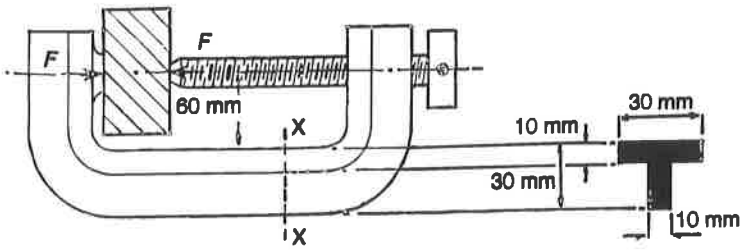

Figure Q.10