UNIVERSITY OF ZAMBIA

SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

MEC 3351 – STRENGTH OF MATERIALS I

Assignment Preparation Sheet 1 - Direct Stress

Assignment Preparation Sheet 2 - Shear Stress **Due Date: 20th July 2023**

Prepare to ALL questions but you will be required to answer THREE of these questions (of which TWO questions from SECTION A) upon advice on the due date.

SECTION A – Direct Stress:

1. Two parallel walls 6 metre apart are stayed together by a steel rod 2.5cm diameter at a temperature of 80^{o}C passing through washers and nuts at each end. Calculate the pull exerted by the rod when it has cooled to 22^{o}C,
    a. If the walls do not yield, and
    b. If the total yield together at the two ends is 1.5mm.

    Take E=2x10^{6}kg/cm^{2} and α=11x10^{-6}/^{o}C.

2. A solid steel bar 50cm long 7cm in diameter, is placed inside an aluminium tube having 7.5cm inside diameter and 10cm outside diameter. The aluminium cylinder is 0.015cm longer than the bar. An axial load of 60000kg is applied to the bar and cylinder through rigid cover plates as shown in Figure Q2. Find the stresses developed in the steel bar and the aluminium tube.

    Assume for steel E=2.2x10^{6}kg/cm^{2} and for aluminium E=0.7x10^{6}kg/cm^{2}.

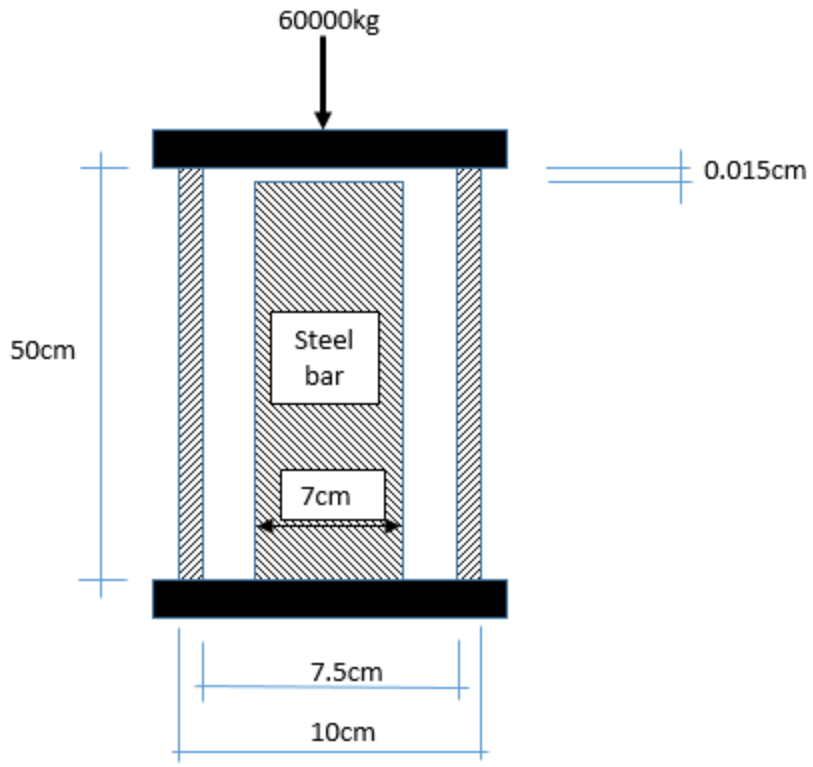

Figure Q2

3. A bar *ABCD* shown in Figure Q3 is subjected to a tensile load of 18000kg. If the stress in the material is limited to 1400kg/cm^2, find the diameter of the portion *BC* and its length if the total elongation of the bar *ABCD* is to be 0.024cm. Take E=2.0 x 10^6 kg/cm^2.

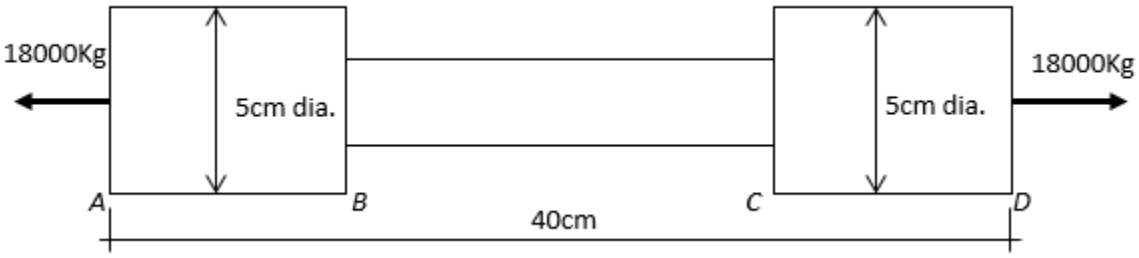

Figure Q3

SECTION B – Shear Stress:

4. A Bracket is riveted to a column by six (6) rivets of equal size as shown in Figure Q4. It carries a load of 60kN at a distance of 200mm from the centre of the column. If the maximum shear stress in the rivet is limited to 150 MPa, determine the diameter of the rivets.

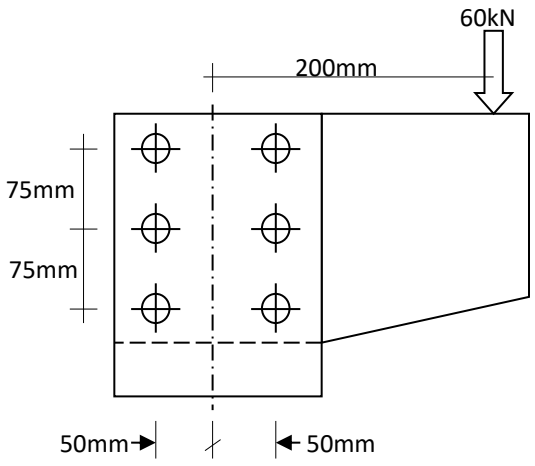

Figure Q4

5. A bracket in the form of a plate is fitted to a column by means of four rivets A, B, C, D in the same vertical line as shown in Figure Q5.

   Determine the diameter of the rivets which are made of steel having a yield stress in shear of 240 MPa. Take a factor of safety of 1.5.

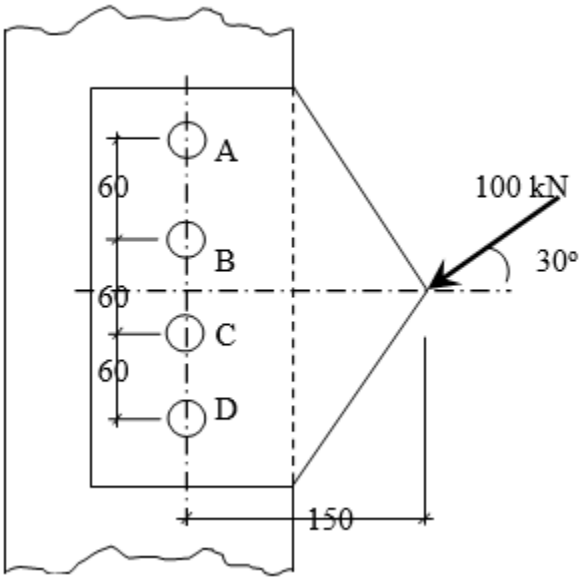

Figure Q5

6. In a lap-joint shown in Figure Q6, two steel flat plates are held together with the help of two symmetrically placed rivets. With the left plate firmly fixed on the left side, the assembly is designed to support a tensile loading of 10kN applied to the joint at point *A* which is located at an eccentricity of 12mm. Determine the minimum diameter of the

rivets capable of supporting this joint, given that the rivet material has a maximum allowable shear stress value of 65N/mm^2.

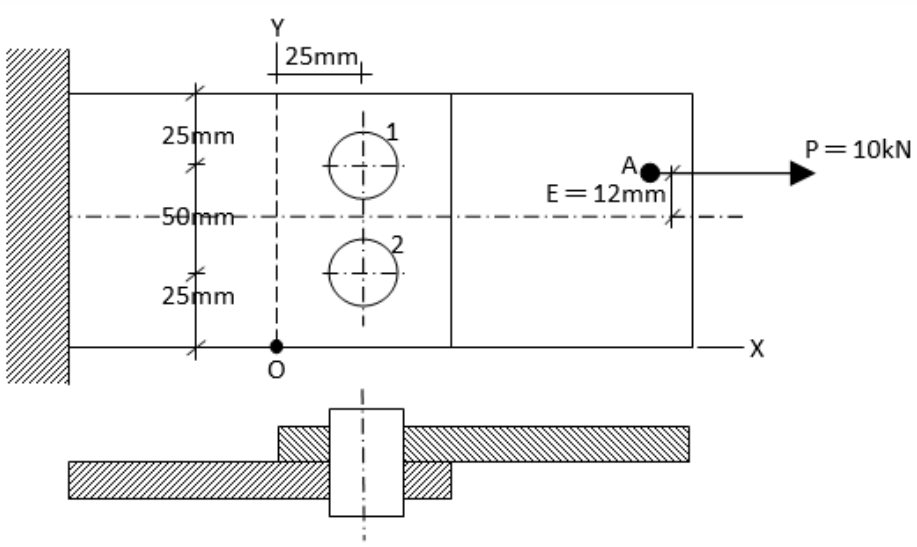

Figure Q6