5. (a) A tensile load of 50 kN is acting on the rod of 50 mm diameter and length of 5 m. Determine the length of a bore of 25 mm that can be made central in the rod, if the total extension is not to exceed by 25 percent under the same tensile load. Take E = 2.05 x 10^5 N/mm^2. **10**

(b) A masonry dam 6 m high is 1.5 m wide at the top and 4.5 m wide at the base, with vertical water face. Determine the normal stresses at the toe and the heel for reservoir empty and reservoir full conditions. Take unit weight of masonry as 23.54 kN/m^3 and c = 1 **10**

6. (a) At a point in an elastic material under strain, there are normal stresses of 60 N/mm^2 (tensile) and 40 N/mm^2 (compressive) respectively at right angle to each other, with positive shearing stress of 20 N/mm^2. Find (i) principal stresses and the position of principal planes, and (ii) maximum shear stress and its plane. **10**

(b) A load of 100 kN is carried by bracket riveted to the flange plate of a stanchion, as shown in Fig.1. Each rivet is of 24 mm diameter. Calculate the maximum shear stress in any rivet. **10**

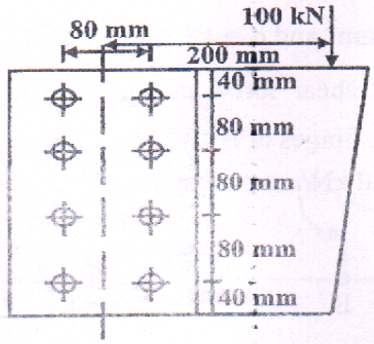

Fig. 1

7. (a) A shaft transmits 300 kW power at 120 r.p.m. Determine (a) the necessary diameter of solid circular shaft (b) the necessary diameter of hollow circular section, the inside diameter being 2/3 of the external diameter. The allowable shear stress is 70 N/mm^2. Taking the density of material is 77 kN/m^3, calculate the % saving in the material if hollow shaft is used. **12**

(b) A cylindrical shell 2 m long and 90 cm internal diameter and 12 mm metal thickness is subjected to an internal pressure of 1.6 N/mm^2. Determine (i) maximum intensity of shear stress, and (ii) change in the dimensions of the shell. Take E = 2 x 10^5 N/ mm^2 and 1/m = 0.3. **8**