UNIVERSITY OF NAIROBI

DEPARTMENT OF MECHANICAL ENGINEERING

Solid Mechanics

Laboratory Sheets

Curved Beams

Object : To measure the deflection of curved beams when loaded and compare the measured and theoretical values.

Apparatus : Loading frame, four curved beams. Dial gauges and weights.

Procedure: Fix the beams on the loading frame and measure the deflections as indicated on Figs 1 to 4. Record the loads and the corresponding deflections.

Graph : For each beam draw a load versus deflection graphs.
Read off the values at the maximum load applied.

Calculations:

Taking δ_h and δ_v as horizontal and vertical deflections the theoretical deflections are given as follows:

Ring :

$$\delta_v = \left(\frac{\pi}{4} - \frac{2}{\pi}\right)\frac{PR^3}{EI}$$

$$\delta_h = \left(\frac{2}{\pi} - \frac{1}{2}\right)\frac{PR^3}{EI}$$

Half ring:

$$\delta_v = \frac{\pi}{2} \cdot \frac{PR^3}{EI}$$

$$\delta_h = 2 \cdot \frac{PR^3}{EI}$$

Davit :

$$\delta_v = \left(\frac{\pi}{4} + \frac{h}{R}\right)\frac{PR^3}{EI}$$

$$\delta_h = \left(1 + \frac{h}{R}\right)\frac{PR^3}{EI}$$

Bracket: $\delta_h = \frac{Pb^2c}{2EI}$

$\delta_v = \frac{P}{3EI}\left(\frac{a^3}{4} + 3b^2c + c^3\right)$

Take E= 190 GN/m^2

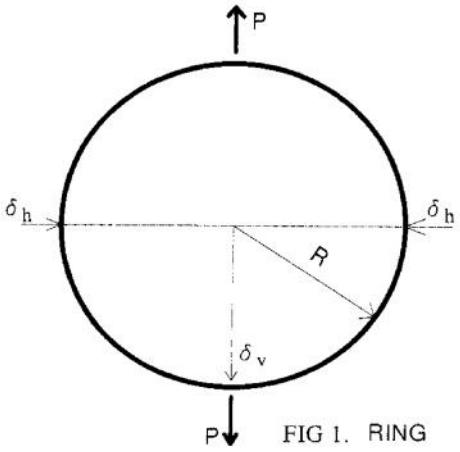

FIG 1. RING

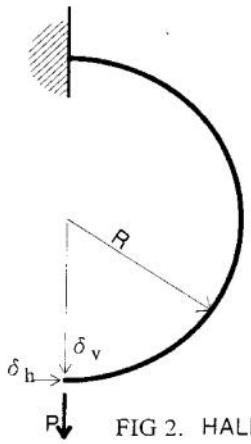

FIG 2. HALF RING

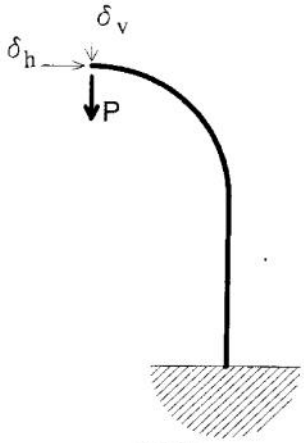

FIG 3. Davit

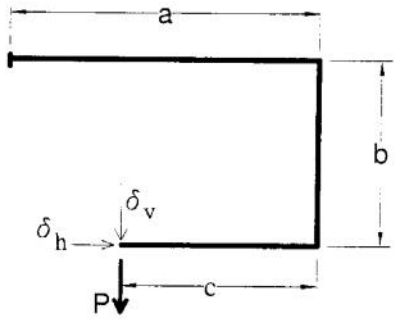

FIG 4. Bracket