1. A rectangular bar bent into a semicircle is built in at one end and is subjected to radial pressure of p lb per unit length (see Fig. 1). Write the general expressions for axial force $P(\theta)$, shear force $V(\theta)$, and bending moment $M(\theta)$. Show positive directions assumed for P, V, and M on a free-body diagram. (25%)
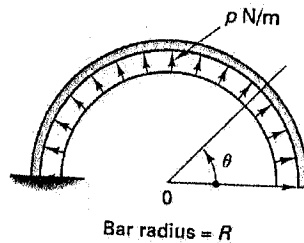

Fig. 1

2. As shown in Fig. 2, each of the two identical shafts is attached to a rigid wall at one end and supported by a bearing at the other end. The gears attached to the shafts are in mesh. Determine the reactive torques at A and C when the torque is applied to gear B. (25%)
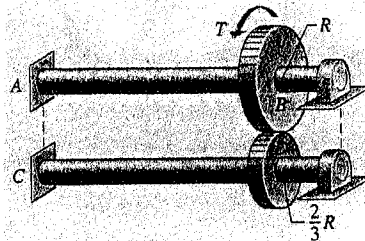

Fig. 2

3. If the rectangular block shown in Fig. 3 is subjected to a uniform pressure of $p = 20$ kPa. Take $E = 600$ kPa, $v = 0.45$. Determine (a) The dilation and (b) The change in length of each side. (25%)
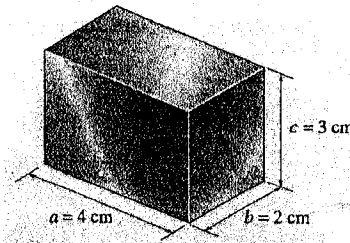

Fig. 3

4. The fence board weaves between the three smooth fixed posts shown in Fig. 4, if the posts remain along the same line. The board has a width of 150 mm and a thickness of 12 mm. $E_w = 10$ GPa. Assume the displacement of each end of the board relative to its center is 75 mm. Determine (a) The elastic curve of the board. (b) The maximum bending stress in the board. (25%)
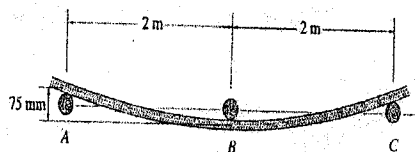

Fig. 4