**NATIONAL INSTITUTE OF TECHNOLOGY SILCHAR**
**ENGINEERING MECHANICS**
**First / Second Semester (All Branch)**

**COURSE NO. ME 101** **L T P C**
**3 1 0 4**

**ASSIGNMENT - 2**

1. An electric street lamp is suspended from a small ring $B$ supported by two wires $AB$ and $CB$, the ends $A$ and $C$ of which are on the same level (Fig. A). Assuming these wires to be perfectly flexible and neglecting their weights, find the force produced in each if the weight of the lamp is 15 $N$, the length of each wire, 10 $cm$, and the sag $DB$, 4 $cm$. *Ans.* $S_{AB} = S_{BC} = 18.8\ N$

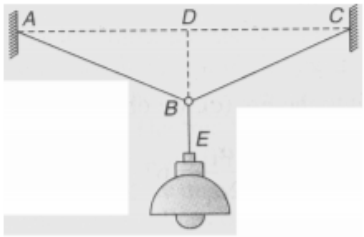

FIG. A

2. A weight $Q = 500\ N$ hanging on a cable $BD$ is supported at point $B$ by a cable $AB$ and a boom $BC$ which is hinged at $C$ (Fig. B). Neglecting the weights of the cable and the boom and assuming an ideal hinge at $C$, determine the forces transmitted to the mast at points $A$ and $C$. The angles of triangle $ABC$ are indicated in the figure. *Ans.* $S_A = 574\ N$, $S_C = 906\ N$

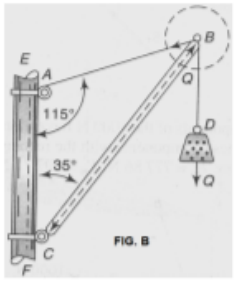

FIG. B

3. Two smooth spheres, each of radius $r$ and weight $Q$, rest in a horizontal channel having vertical walls, the distance between which is $b$ (Fig. C). Find the pressures exerted on the walls and floor at the points of contact $A$, $B$ and $D$. The following numerical data are given *: $r = 10\ cm$, $b = 36\ cm$, $Q = 100\ N$. Ans.* $R_A = R_B = 133\ N$, $R_D = 200\ N$

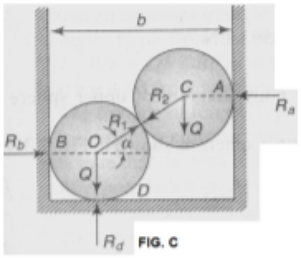

FIG. C

*[Turn over]*

4. A cord $ACB$ 20 $cm$ long is attached at points $A$ and $B$ to two vertical walls, 16 $cm$ apart. A pulley $C$, so small that we can neglect its radius, carries a suspended load $P = 36\ N$ and is free to roll without friction along the cord (Fig. D). Determine the position of equilibrium, as defined by the distance $x$, that the pulley will assume and also the tensile force in the cord. *Ans.* $x = 6\ cm$, $S = 30\ N$

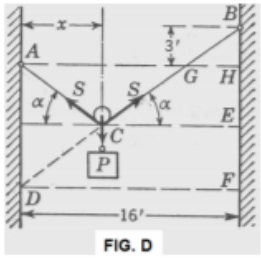

FIG. D

5. An electric-light fixture of weight $Q = 40\ N$ is supported as shown in Fig. E. Determine the tensile forces $S_1$ and $S_2$ in the wire $BA$ and $BC$ if their angles of inclination are as shown. *Ans.* $S_1 = 29.3\ N$; $S_2 = 20.7\ N$.

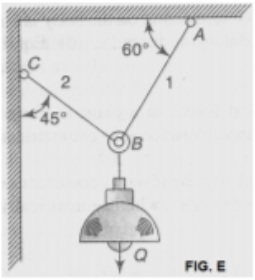

FIG. E

6. A ball of weight $Q = 12\ N$ rests in a right-angled trough, as shown in Fig. F. Determine the forces exerted on the sides of the trough at $D$ and $E$ if all surfaces are perfectly smooth. *Ans.* $R_d = 10.4\ N$; $R_e = 6\ N$.

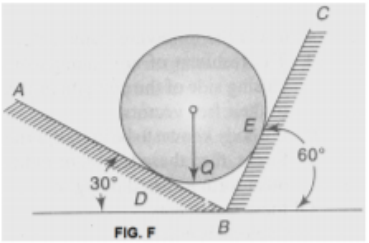

FIG. F

7. A circular roller of weight $Q = 100\ N$ and radius $r = 6\ cm$ hangs by a tie rod $AC = 12\ cm$ and rests against a smooth vertical wall at $B$, as shown in Fig. G. Determine the tension $S$ in the tie rod and the force $R_b$ exerted against the wall at $B$. *Ans.* $S = 115.5\ N$; $R_b = 57.7\ N$.

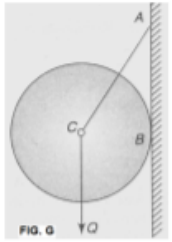

FIG. G

8. What axial forces does the vertical load $P$ induce in the members of the system shown in Fig. H? Neglect the weights of the members themselves and assume an ideal hinge at $A$ and a perfectly flexible string $BC$. *Ans.* $S_1 = P\ cosa$, *tension;* $S_2 = P\ cota$, *compression.*

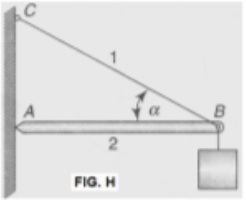

FIG. H

9. hat axial forces does the vertical load $P$ induce in the members of the system shown in Fig. I? Make the same idealizing assumptions as in Prob. 4. Ans. $S_1 = P \tan\alpha$, *tension;* $S_2 = P \sec\alpha$, *compression.*

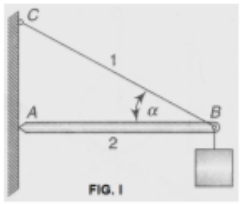

FIG. I

10. A right circular roller of weight $W$ rests on a smooth horizontal plane and is held in position by an inclined bar $AC$ as shown in Fig. J. Find the tension $S$ in the bar $AC$ and the vertical reaction $R_b$ at $B$ if there is also a horizontal force $P$ acting at $C$. *Ans.* $S = P \sec\alpha$; $R_b = W + P\tan\alpha$.

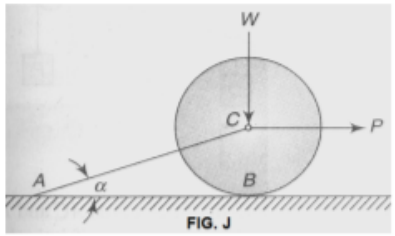

FIG. J

11. A pulley $A$ is supported by two bars $AB$ and $AC$ which are hinged at points B and C to a vertical mast $EF$ (Fig. K). Over the pulley hangs a flexible cable $DG$ which is fastened to the mast at $D$ and caries at the other end $G$ a load $Q = 2$ *tons*. Neglecting friction in the pulley, determine the forces produced in the bars $AB$ and $AC$. The angles between the various members are show in the figure. *Ans.* $S_2 = 3.46$ *tons;* $S_1 = 0$.

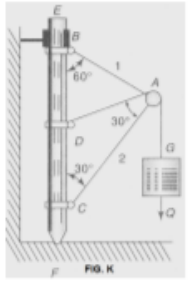

FIG. K

12. Two smooth circular cylinders, each of weight $W =$ 100 $N$ and radius $r = 6$ *cm*, are connected at their centers by a string $AB$ of length $l = 16$ *cm* and rest upon a horizontal plane, supporting above them a third cylinder of weight $Q = 200$ $N$ and $r = 6$ *cm* (Fig. L). Find the forces $S$ in the string $AB$ and the pressures produced on the floor at the points of contact $D$ and $E$. Ans. $S = 89.4$ *N, tension;* $R_d = R_c = 200$ *N.*

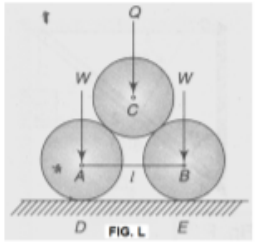

FIG. L

13. Two identical rollers, each of weight $Q = 100$ $N$, are supported by an inclined plane and a vertical wall as shown in Fig. M. Assuming smooth surfaces, find the reactions induced at the points of support $A$, $B$ and $C$. *Ans.* $R_a = 86.6$ *N;* $R_b = 144$ *N;* $R_c = 115$ *N.*

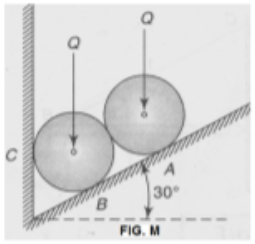

FIG. M

14. A weight $Q$ is suspended from point $B$ of a cord $ABC$, the ends of which are pulled by equal weight $P$ overhanging small pulleys $A$ and $C$ which are on the same level (Fig. N). Neglecting the radii of the pulleys, determine the sag $BD$ if $l = 12$ *cm,* $P = 20$ *N, and* $Q = 10$ *N. Ans.* $BD = 1.55$*cm.*

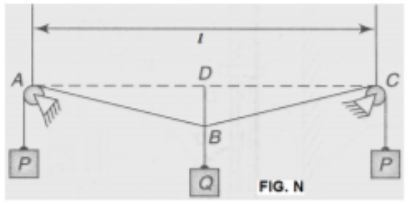

FIG. N

15. A weight $Q$ is suspended from a small ring $C$, supported by two cords $AC$ and $BC$ (Fig. O). The cord $AC$ is fastened at $A$ while the cord $BC$ passes over a frictionless pulley at $B$ and carries the weight $P$ as shown. If $P = Q$ and $\alpha = 50^0$, find the value of the angle $\beta$. *Ans.* $\beta = 80^0$

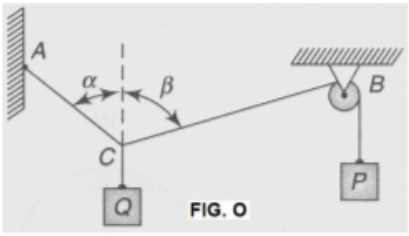

FIG. O

16. Two rollers of weight $P$ and $Q$ are connected by a flexible string $DE$ and rest on two perpendicular planes $AB$ and $BC$, as shown in Fig. P. Find the tension $S$ in the string and the angle $\phi$ that it makes with the horizontal when the system is in equilibrium. The following numerical data are given: $P = 60$ $N$, $Q = 100$ $N$, $\alpha = 30^0$. Assume that the string is inextensible and passes freely through slots in the smooth inclined planes $AB$ and $BC$. *Ans.* $S = 72$ *N;* $\phi = 16^0$.

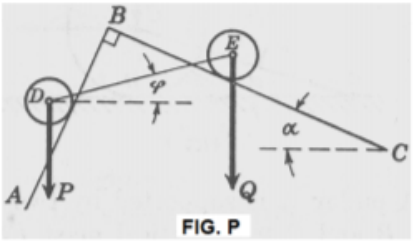

FIG. P

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