BE–I/11(A)

236219

(New Course)

## ENGG. MECHANICS—COURSE NO. ESC-103

Time Allowed—3 *Hours*　　　　　　　*Maximum Marks*—100

Note :— Attempt *Five* questions in all, selecting at least *two* from each Section. Assume missing data if any.

Section A

1.　The portable reel is used to wind up and store an air hose. The tension in the hose is 100 N and a vetical 200 N force is applied to the handle in order to steady the reel frame. Determine the minimum force P which must be applied perpendicular to the handle DE and the vertical components of the force reactions at the feet A, B, and C. The diameter of the coil of reeled hose is 300 mm, and the weight of the loaded reel and its frame may be neglected. Note that force P is perpendicular to OD. Refer figure.


Dimensions in millimeters
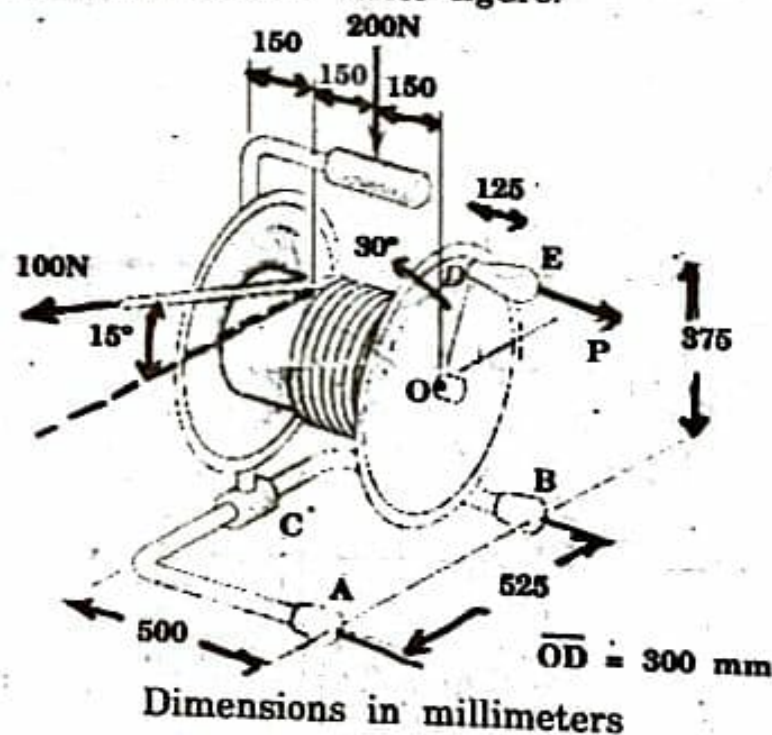
2. The uniform rod with center of mass at G is supported by the pegs A and B, which are fixed in the wheel. If the coefficient of friction between the rod and pegs is µ, determine the angle θ through which the wheel may be slowly turned about its horizontal axis through O, starting from the position shown, before the rod begins to slip. Neglect the diameter of the rod compared with the other dimensions. Refer figure.
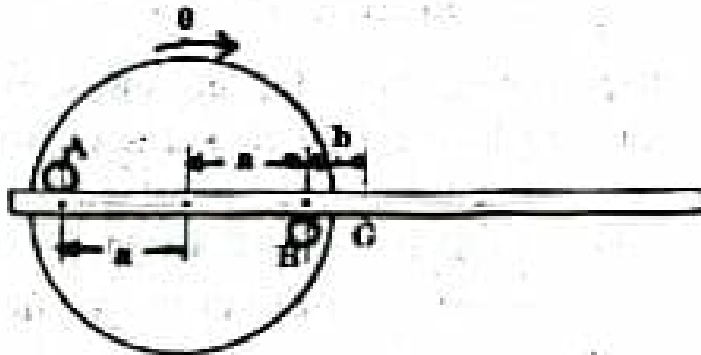
3. The hinged frames ACE and DFB are connected by two hinged bars, AB and CD, which cross without being connected. Compute the force in AB.
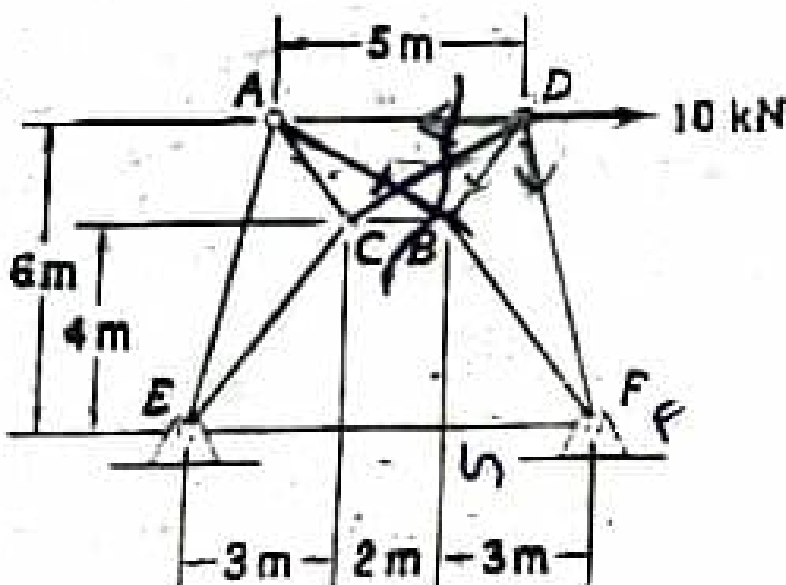
7. Determine the moments of inertia of the shaded area with respect to the centroidal axes parallel and perpendicular to the side AB.
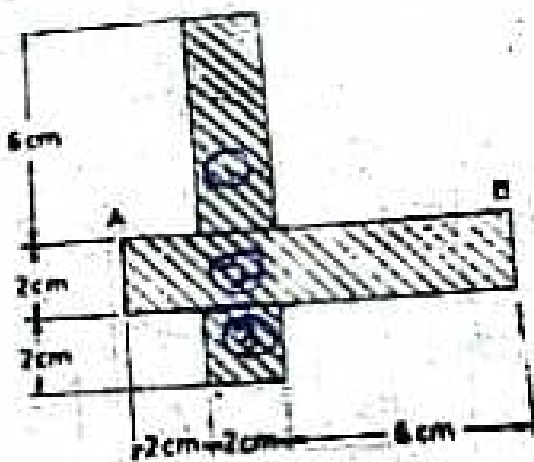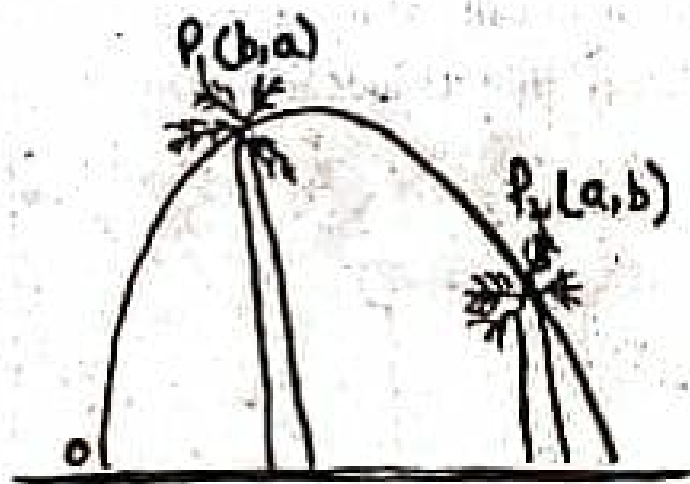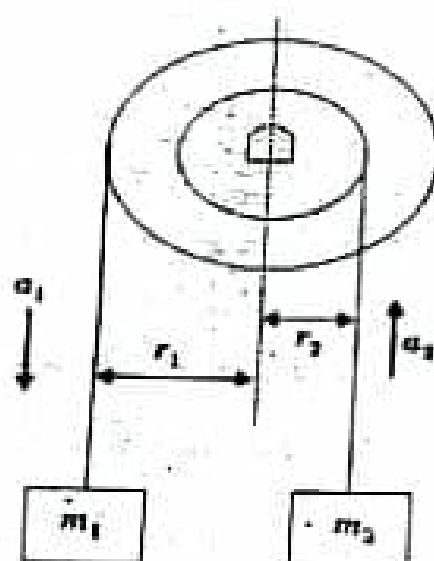

Section B

8. A ball is thrown at a velocity v to clear two trees P_1 and P_2 as shown in figure. Prove that the angle of projection :

(i) $\tan \alpha = \dfrac{a^2 + b^2 + ab}{a+b}$

(ii) Range $R = (a + b) - \dfrac{ab}{a+b}$

6. Considering the inertial and the frictional effect absent. Determine the downward acceleration of mass m_1 as shown in figure. Take the $m_1 = 8$ kg. $m_2 = 12$ kg, $r_1 = 2r_2 = 20$ cm.

7. In eight ball game, the 8 ball needs to be pocketed. The position of the striker ball C which will strike the 8 ball to pocket at F is shown in figure. Each of the balls weigh 170 gm and radius 28 mm. Determine the angle of shoot of C ball to hit and send 8 ball to pocket F. Determine the post collision direction of movement of C ball. Also determine the percentage of initial kinetic energy that C ball imparted to 8 ball.

(a)

(b)
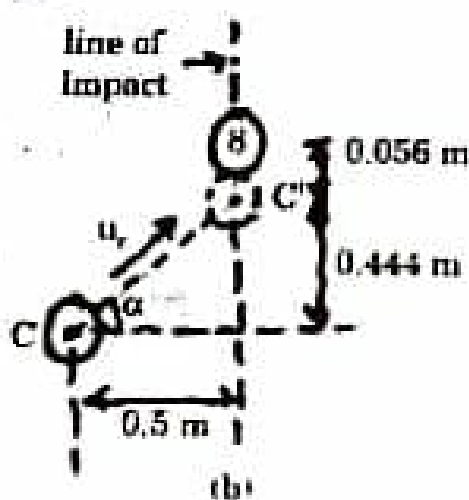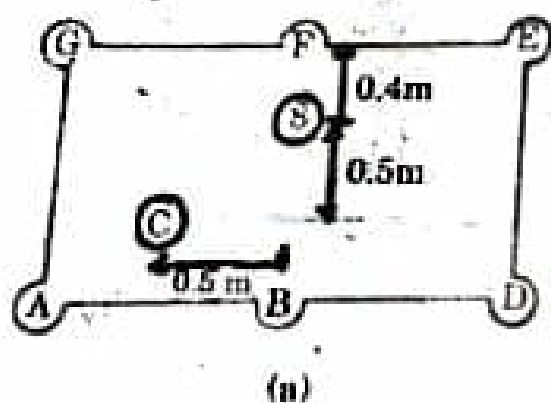
In the speed governor device as shown in figure, determine the rotational speed in rpm to just lift the 2 kg weight, which can slide along the vertical shaft.