

Indian Institute of Engineering Science and Technology, Shibpur
 B.Tech. (AE, CE, ME, MT, MN, CST, ETC, IT, EE) 2nd Semester End-semester
 Examination, July, 2021
Mechanics (AM 1201)

Full marks: 50

Time: 1 Hour 30 Minutes

Notations stand for their usual meanings

Marks of each question are shown in the right

(i) Take $g = 9.81 \text{ m/s}^2$.

(ii) Assume any other data not given in the question.

(iii) Question 1 is compulsory; also answer any **four (04)** Questions from the rest

1. Determine I_x , I_y and I_{xy} for the rectangular plate (as shown in Fig. 1) with three equal circular holes. [10]

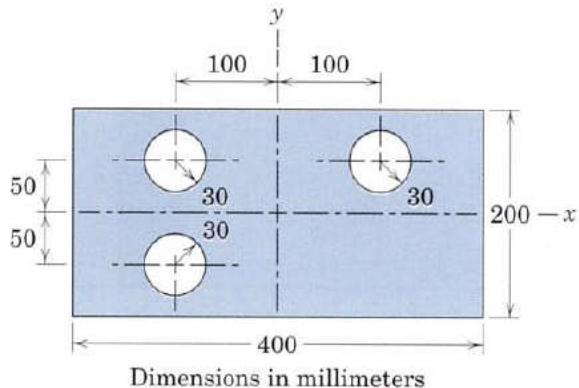


Fig.1

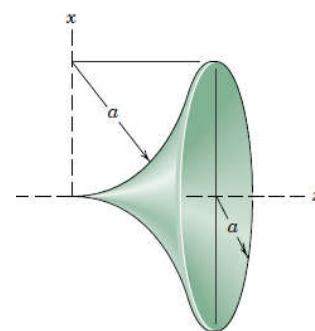


Fig.2

2. Determine the volume within the bell-shaped shell shown in Fig 2. [10]
3. The two wedges are used to position the vertical column under a load L as shown in Fig 3. What is the least value of the coefficient of friction μ_2 for the bottom pair of surfaces for which the column may be raised by applying a single horizontal force P to the upper wedge? [10]

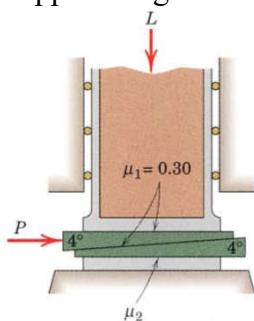


Fig.3

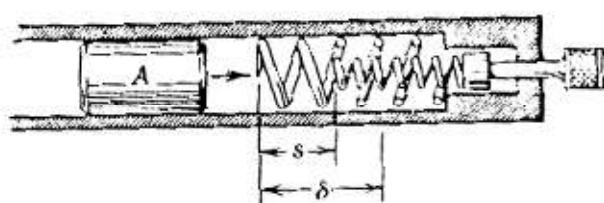


Fig.4

4. The nest of two springs is used to bring the 0.5-kg plunger A to a stop from a speed of 5 m/s and reserve its direction of motion (as shown in Fig 4). The inner spring increases the deceleration, and the adjustment of its position is used to control the exact point at which the reversal takes place. If this point is to correspond to a maximum deflection $\delta = 200 \text{ mm}$ for outer spring, specify the adjustment of the inner

spring by determining the distance s . The outer spring has a stiffness of 300 N/m and the inner one a stiffness of 150 N/m. [10]

5. The system is released from rest in the position as shown Fig 5. Calculate the tension T in the cord and the acceleration a of the 30- kg block. The small pulley attached to the block has negligible mass and friction. [10]

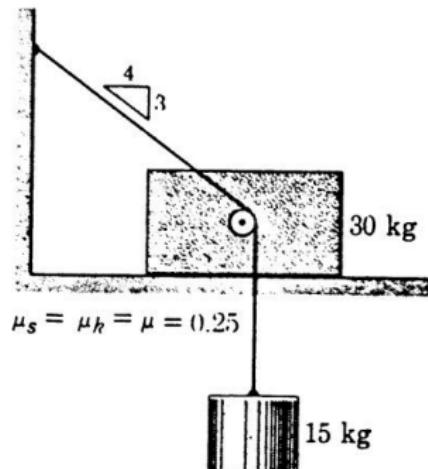


Fig.5

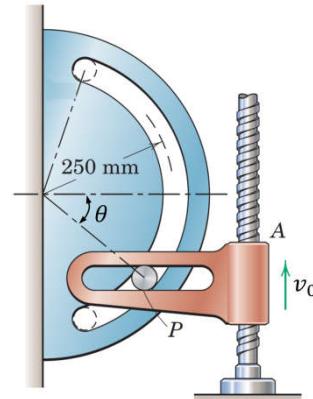


Fig.6

6. The motion of the pin P in the fixed circular slot (as shown in Fig. 6) is controlled by the guide A, which is being elevated by its lead screw with a constant upward velocity $v_0 = 2$ m/s for an interval of its motion. Calculate both the normal and tangential components of acceleration of pin P as it passes through the position for which $\theta = 20^\circ$. [10]
7. The figure 7 shown n spheres of equal mass m suspended in a line by wire of equal length so that the spheres are almost touching each other. If sphere 1 is released from the dotted position and strikes sphere 2 with a velocity v_1 , write an expression for the velocity v_n of the n^{th} sphere immediately after it struck by the one adjacent to it. The common coefficient of restitution is e . [10]

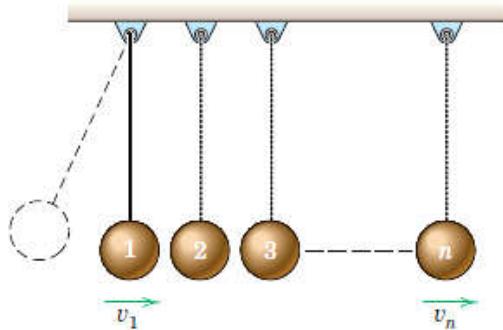


Fig. 7