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Total number of printed pages - 9

B.TECH

BENG 1101

2ND SEMESTER EXAMINATION – 2006

MECHANICS

Full Marks – 70

Time – 3 Hours

The figures in the right hand margin indicate full marks for the questions.

Answer Question No. 1 which is compulsory and any five from the remaining questions.

1. Answer in brief the following questions : 2×10

   (a) State the Parallelogram Law. What do you mean by equilibrium of a system of forces ?

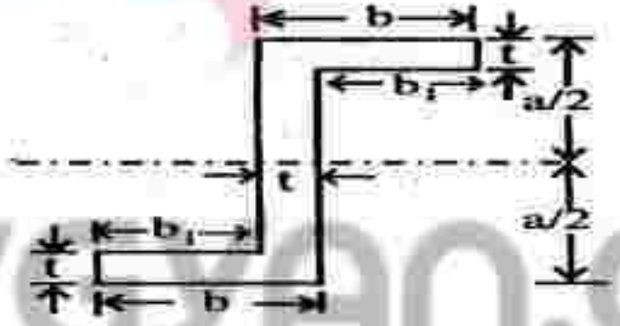
   (b) What is meant by Free Body Diagram ? Draw the free body diagram of the two spheres separately shown is Fig - 3a in the 4th page

P.T.O.

(c) Distinguish between 'Method of Joints' and 'Method of Sections' in the analysis of Plane Trusses.

(d) Distinguish between Static Friction and Kinetic Friction. In which case the value of coefficient of friction and limiting angle of friction are higher.

(e) Indicate the centroid of the lamina shown in (Fig.1e). What will be its moment of inertia about the horizontal axis of symmetry.

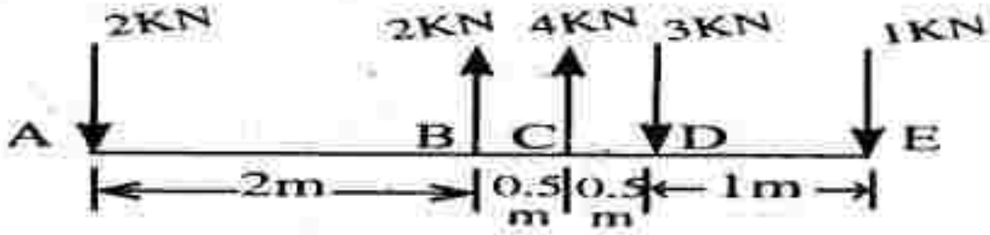


(Fig.1e)

(f) When a body slides down on inclined surface, what is the acceleration of the body.

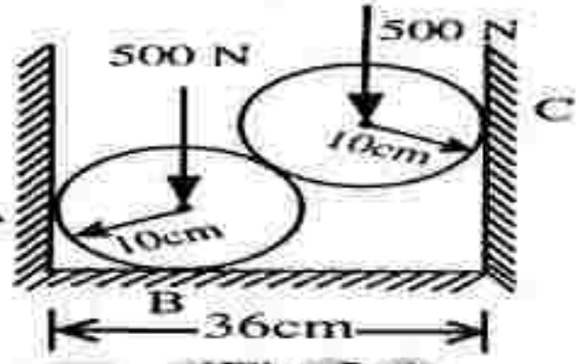
(g) A ball is thrown up. Where the sum of K.E and P.E. will be maximum.

(c) Five forces are acting on a body as shown in Fig.-2c. Determine the resultant force and the couple. 4



(Fig. 2c)

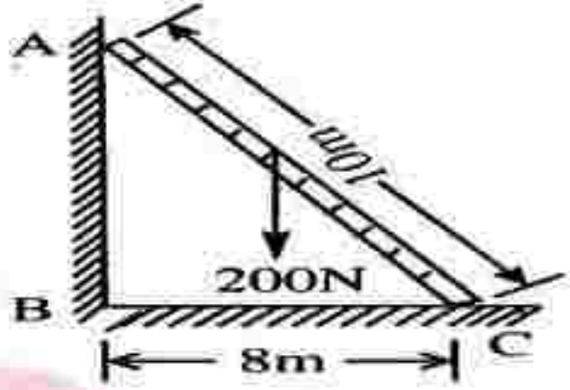
3. (a) Two spheres, each of weight 500 N and of radius 10 cm rest in a horizontal channel of width 36 cm as shown in Fig. 3a. Find the reactions at the contact points A, B and C. 5



(Fig.3a)

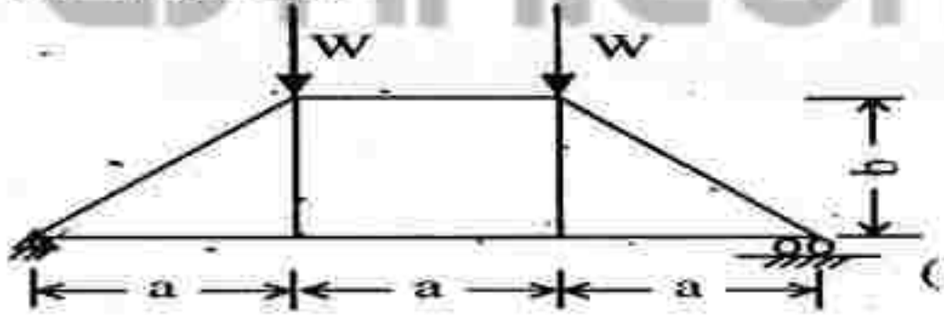
(b) A uniform ladder of length 10 m and weighing 200 N is placed against a smooth vertical wall with its lower end 8m from the wall (Fig.3b). In this position the ladder is just about to slip. Determine : (i) the

co-efficient of friction between the ladder and the floor, and (ii) frictional force acting on the ladder at the point of contact between ladder and floor. 5



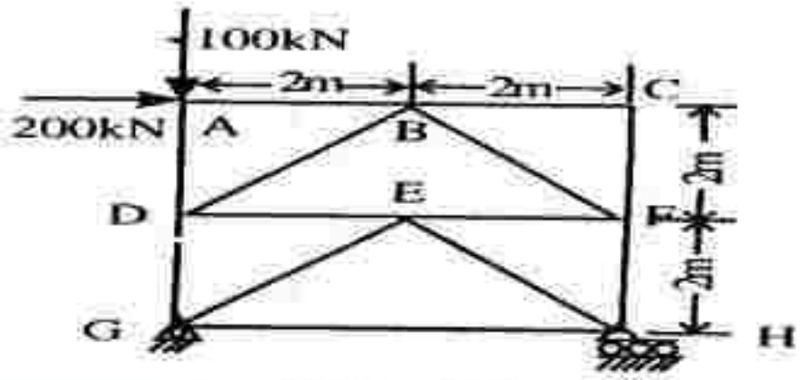
(Fig.3b)

4 (a) What is meant by 'Perfect Frame'? Is the frame shown in (Fig.4a) is a perfect one ? If not, suggest how the frame can be converted to a perfect one with minimum addition of member. 2



(Fig.4a)

(b) Determine the forces in the members of the plane truss shown in. Fig.- 4b. Indicate the nature of the forces also. 8

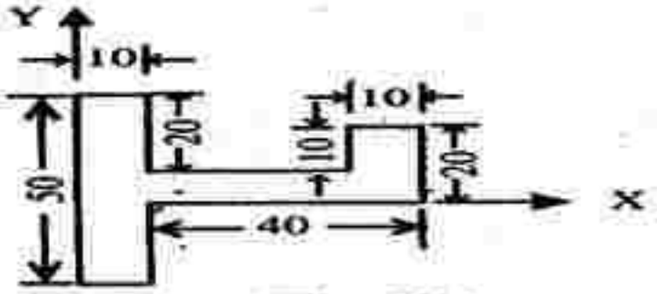


(Fig.2b)

3. (a) Find out the centroid of a semicircular area of radius R shown in Fig -5a. 3

(Fig.5a)

(b) Locate the centroid of the area shown in Fig -5b with respect to the given coordinate axes. Compute its moment of inertia about y-axis. All dimensions are in millimeter. 7



(Fig.5b)

6. (a) A stone is dropped into a pot-hole and the echo of its impact on the bottom is heard 4.5 seconds later. Taking the velocity of sound in air as 336 m/s, calculate the depth of the pot-hole. 5

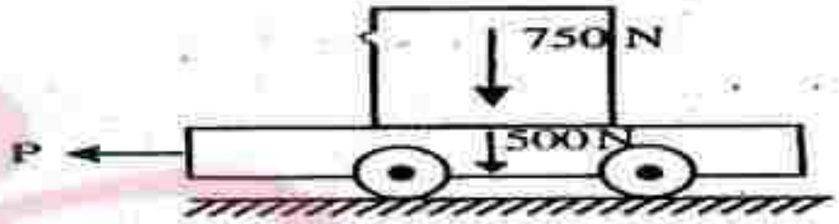
(b) A cage descends a mine shaft with an acceleration of 0.6m/sec . After the cage has traveled 30m a stone is dropped from the top of the shaft. Determine 5

(i) the time taken by the stone to hit the cage, and

(ii) the distance traveled by the cage before impact.

7. (a) A 750 N crate rests on a 500 N cart. The coefficient of friction between the crate and

the cart is 0.3 and between cart and the road is 0.2. If the cart is to be pulled by a force P (Fig.-7a), such that the crate do not slip, determine the (i) the maximum allowable magnitude of P and (ii) the corresponding of acceleration of the cart. 7



(b) A particle initially at rest is submitted to the action of a force $X = kt$. Prove that the $\frac{X}{\dot{X}}$ ratio increases as a linear function of time. 3

8. (a) A glass marble, whose weight is 0.2 N, falls from a height of 10m and rebounds to a height of 8 meters. Find the impulse and the average force between the marble and the floor, if the time during which they are in contact is 1/10 of a second. 4

(b) In the system shown in Fig.-8b, friction and mass of the pulley are both negligible. Find the acceleration of m_2, if $m_1 = 300$ gm and $m_2 = 500$ gm and $F = 1.5$ N. Neglect friction at all contact surfaces. 6