C 57522 (Pages : 3) Name.....

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# COMBINED FIRST AND SECOND SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, JUNE 2009

EN 04.107 (B)—ENGINEERING MECHANICS—(B)

(2004 Admissions)

[ME, PE, AM]

Time : Three Hours Maximum : 80 Marks

*Answer* **all** *questions.*

## Part A

*Each question carries* 5 *marks.*

I. 1 State and prove Lami's theorem.

2 Explain the different types of forces system with neat sketch.

3 State the Coloumb's Law"s of friction.

4 State and prove the parallel axis theorem.

5 A train picks up speed uniformly from 40 km/h to 80km/h over a distance of 500 m. Find its acceleration.

6 What do you mean by "instantaneous centre of rotation"? How will you locate it?

7 State and prove the work energy equation.

8 Explain moment of momentum.

II. (a) An automobile is pulled by means of two trucks as shown in Figure 1. If the resultant of the two forces acting on the automobile is 25kN being directed along the positive direction of X- axis, determine the angle θ of the cable attached to the track at B such that the force $F_B$ in this cable is minimum. What is the magnitude of force in each cable when this accurs?

*Or*

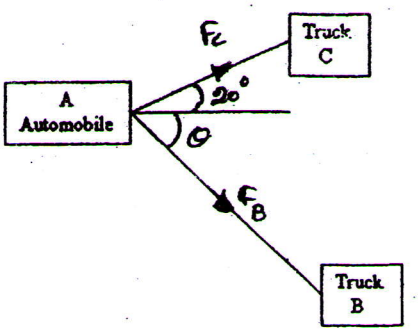


Figure 1

**Turn over**

(b) Two identical spheres each of weight 2.5 kN and radius 20 cm are kept in a horizontal channel of width 70 cm as shown in Figure 2. Determine the reactions at the points of contact P, Q and R.

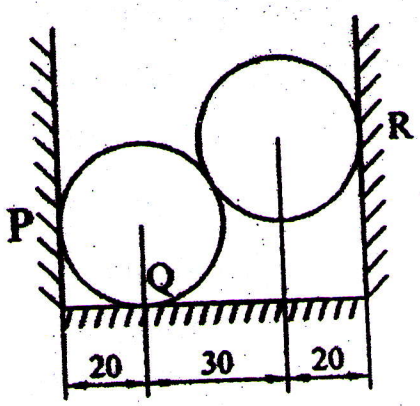


Figure 2

III. (a) Find the forces in the various members of the frame shown in Figure 3.

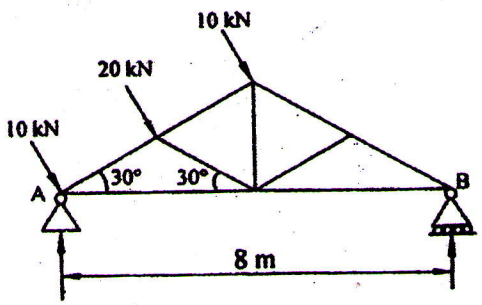


Figure 3

*Or*

b) A block of weight $W_1$ = 1290 N rests on a horizontal surface and supports another block of eight $W_2$ = 570 N on top of it as shown in Figure 4. Block of weight $W_2$ is attached to a vertical wall by an inclined string AB. ind the Force 'P' applied to the lower block, that will be necessary to cause the slipping to impend. Coefficient of friction between blocks 1and 2 = 0.25 and coefficient of friction between block 1 and horizontal surface = 0.40.

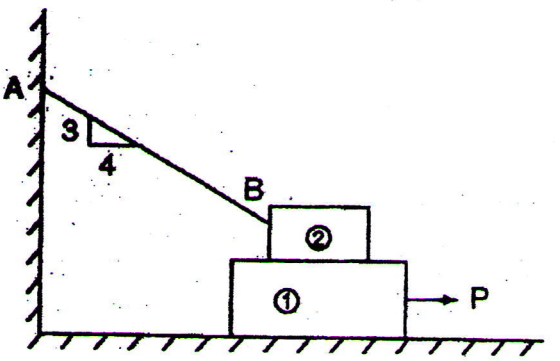


Figure 4

IV. (a) A cage descends in a mine shaft with an acceleration of 0.5 m/s$^2$. After the cage has travelled 25 m., a stone is dropped from the shaft. Determine the :

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

(ii) distance travelled by the cage before impact.

*Or*

(b) A gun is fired, aimed at a ball, from a ground position simultaneously as the ball is let govertically down. Show that the shot will hit the ball regardless of the initial velocity of the shot and the distances.

V. (a) A string 1.2 m. long can just support a mass of 5 kg. A mass of 3 kg is tied and its end and is revolved uniformly in a horizontal plane, the other end of the string being attached to a fixed point. Find the maximum rotational speed in r.p.m. that can be made by the string without its breaking.

*Or*

(b) A flywheel weighing 5000 N and having a radius of gyration 1 m, looses its speed from 500 r.p.m. to 300 r.p.m. in 2 minutes. Calculate (i) the retarding torque acting on it ; (ii) change in kinetic energy during the above period and (iii) change in its angular momentum during this period.