

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 1118

Roll No.

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B. Tech.

(SEM. I) ODD SEMESTER THEORY
EXAMINATION 2013-14
ENGG. MECHANICS

Time : 3 Hours

Total Marks : 100

- Note :—(i) Attempt all the questions.
(ii) Assume missing data suitably, if any.

SECTION—A

1. You are required to answer all the parts : (10×2=20)
- (a) State and explain law of forces.
 - (b) State Varignon's theorem.
 - (c) What is perfect truss ? How it differ from an imperfect truss ?
 - (d) Write down the statement of parallel axis theorem with figure.
 - (e) State D'Alembert's principle.
 - (f) What do you understand by relative velocity ?
 - (g) Friction is desirable and undesirable both. Explain.
 - (h) What is the equilibrium ? Write the equations of equilibrium for non concurrent force system.
 - (i) Explain principle of transmissibility of forces.
 - (j) A body of mass 100 kg is moving relative to a rough surface. Calculate the frictional resistance offered by the surface if $\mu_s = 0.3$ and $\mu_k = 0.2$.

SECTION—B

2. Answer any three parts of the following : **(3×10=30)**

- (a) Find the unknown force F_3 in the system of forces as shown in figure 1, if $F_1 = 100\text{ N}$, $F_2 = 150\text{ N}$ and the resultant of these three forces (F_1 , F_2 and F_3) is 200 N .

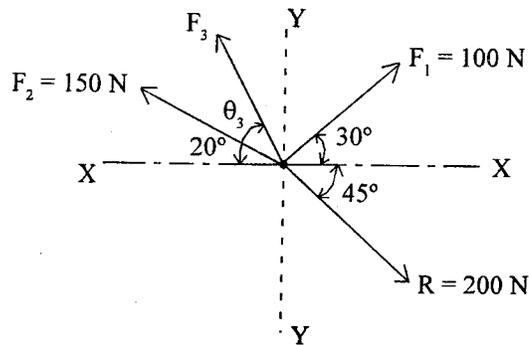


Fig. 1

- (b) An equilateral triangular plate of sides 200 mm is acted upon by four forces as shown in figure-2. Determine the magnitude and direction of the resultant of this system of forces and its position from A.

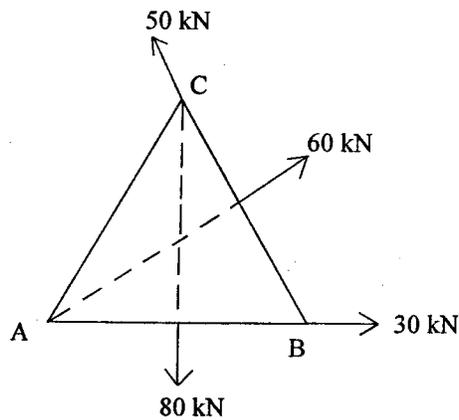


Fig. 2

- (c) For the shaded area shown in figure-3, find the moment of inertia about the line AB.

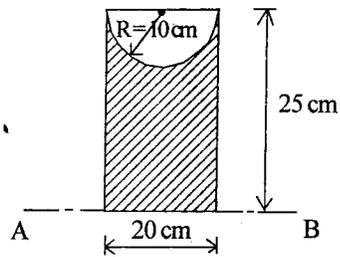


Fig. 3

- (d) The equation of motion of a particle moving in a straight line is given by :

$$S = 18t + 3t^2 - 2t^3$$

where S is the total distance covered from the starting point in meters at the end of t seconds. Find out :

- (i) velocity and acceleration at the start
 - (ii) the time when the particle reaches its maximum velocity.
- (e) Two bodies A and B are connected by a thread and move along a rough horizontal plane ($\mu = 0.3$) under the action of a force 400 N applied to body B as shown in figure-4. Find the acceleration of the two bodies and tension in the thread using D'Alembert's principle.

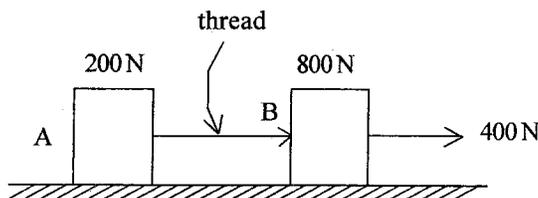


Fig. 4

SECTION—C

3. Attempt all the questions : (5×10=50)

(a) Two spheres rest in a smooth surface as shown in figure-5. Find forces at points of contacts.

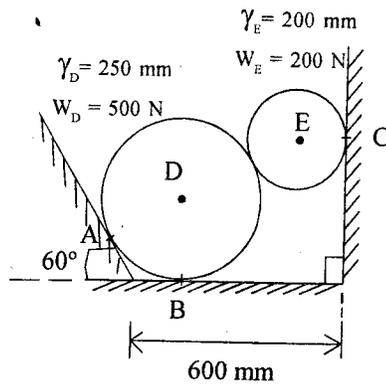


Fig. 5

OR

Two rollers of weights A = 60 N and B = 100 N are connected by a rod in figure-6. Find the tension induced in the rod and the angle that make with the horizontal when the system is in equilibrium.

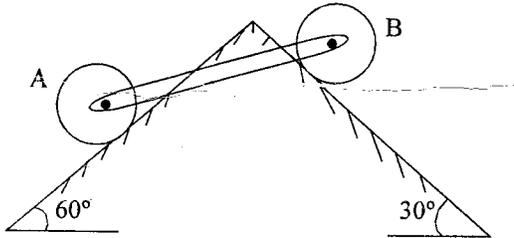


Fig. 6

- (b) Determine the forces in each member of the truss as shown in figure-7.

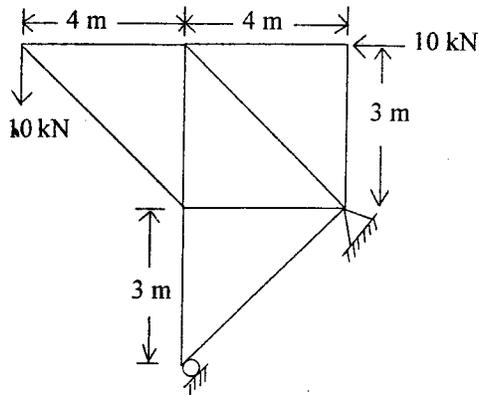


Fig. 7

OR

For a ladder of length 4 m, rest against a vertical wall making an angle of 45° . Determine the minimum horizontal force applied at A to prevent slipping. $\mu = 0.2$ between the wall and ladder, and $\mu = 0.3$ for floor and the ladder. The ladder weight 200 N and a man weight 600 N is at 3 m from A. (Point A is on floor)

- (c) Find the centroid of the shaded area with respect to x and y axis by direct integration method. (Ref. figure-8)

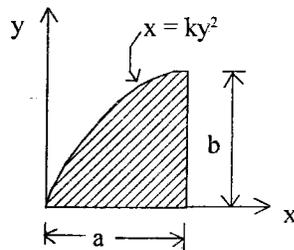


Fig. 8

OR

Find the mass M.I. (Moment of inertia) of a rectangular plate of mass m , base b and height h about the centroidal axis parallel to the base.

- (d) A passenger sitting in a train moving at 54 km/hr is hit by a stone thrown at right angles to it with a velocity of 18 km/hr. Calculate the velocity and the direction with which the stone appears to hit the passenger.

OR

A flywheel had an initial angular speed of 3000 rev/min in clockwise direction, when a constant turning moment was applied to the wheel, it got subjected to a uniform anticlockwise angular acceleration of 3 rev/sec². Determine the angular velocity of the wheel after 20 seconds, and the total number of revolutions made during this period.

- (e) A solid cylinder is released from rest on an inclined plane at an angle θ from horizontal. The mass of the cylinder is m and radius is R . Determine the velocity of cylinder after it has rolled down the incline through a distance S .

OR

In the mechanism shown in figure-9, determine the horizontal force P required to hold the system in equilibrium. The length of each link is 1 m and weight is W newton. (Using virtual work)

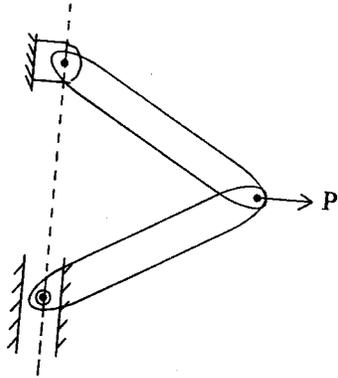


Fig. 9

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