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

PAPER ID : 1118 Roll No. | | | | | | | | | | |

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 $F_1 = 100$ N, $F_2 = 150$ N and the resultant of these three forces (F_1, F_2 and F_3) is 200 N.

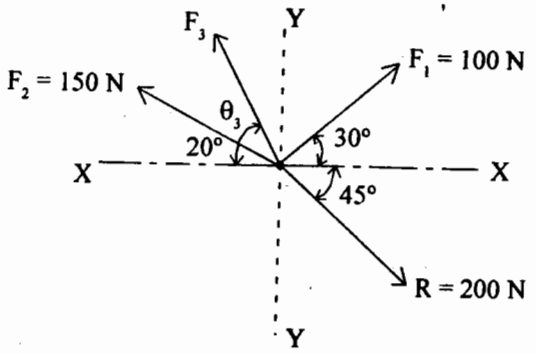

Fig. 1

(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.

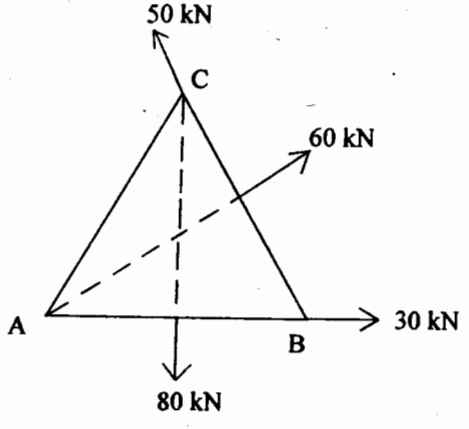

Fig. 2

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

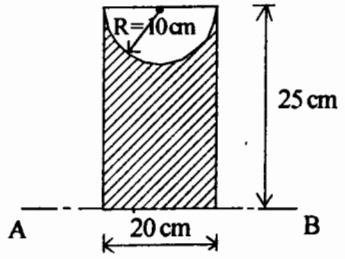

Fig. 3

(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.

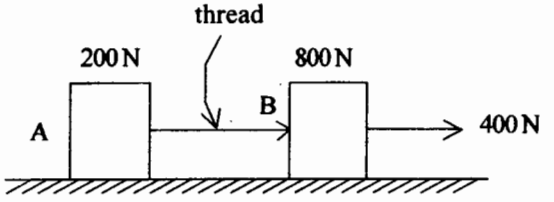

Fig. 4

SECTION—C

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

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

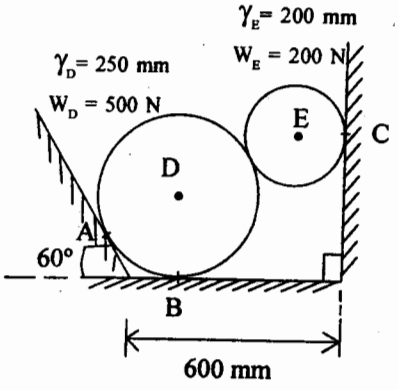

Fig. 5

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.

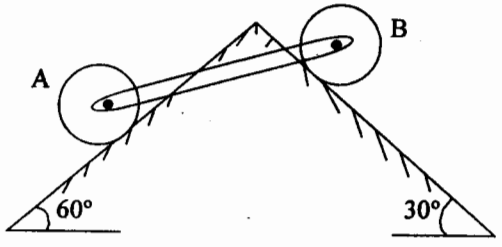

Fig. 6

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

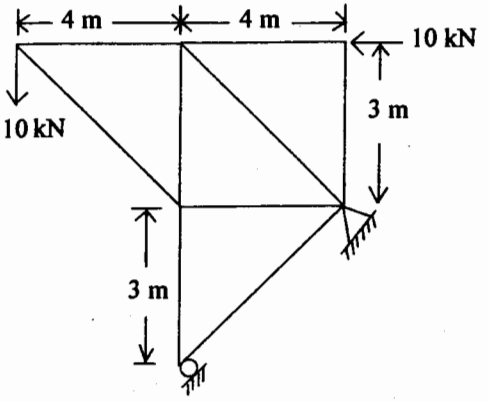

Fig. 7

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)

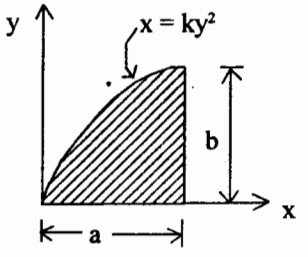

Fig. 8

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/sec^2. 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 be applied to hold the system in equilibrium. The length of each link is 1 m and weight is W newton. (Using virtual work)

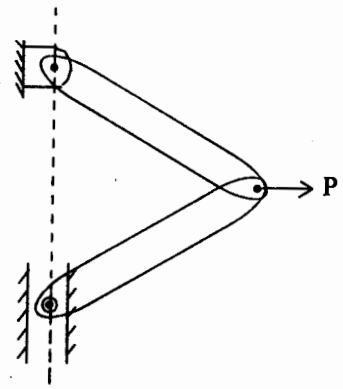

Fig. 9