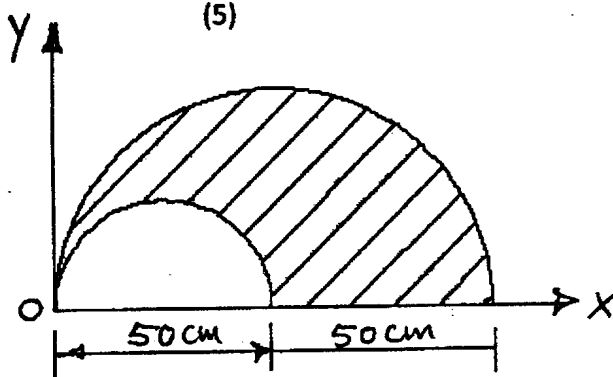


- 1) Question No.1 is compulsory.
- 2) Answer any FOUR from the remaining SIX questions.
- 3) Assume suitable data if necessary.
- 4) Take $g = 9.81 \text{ m/s}^2$.

Q1) Answer All Questions.

a) State and prove Varignon's theorem. (5)

b) Find the centroid of shaded area of the semicircle of diameter 100 cm. (5)



c) In an Asian games event an athlete accelerates uniformly from the start to his maximum velocity in a distance of 4m and runs the remaining distance with that velocity. If the athlete complete the race in 10.4 seconds, determine his initial acceleration and his maximum velocity. (5)

OR

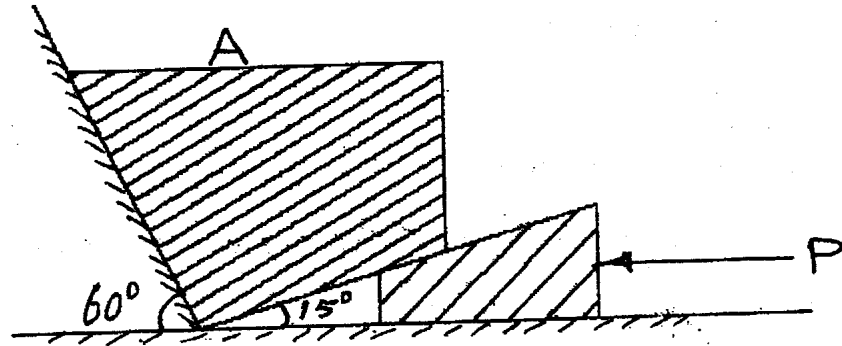
A ball is dropped on to a smooth horizontal floor from a height of 4m. On the second bounce it attains a height of 2.25 m. Find the coefficient of Restitution between the Ball and Floor. (5)

d) A particle travels along the path defined by the parabola $y = 0.5x^2$. If the x-component of velocity is, $v_x = 5t \text{ m/s}$, determine the distance of particle from the origin O and the magnitude of acceleration when $t=1$ seconds. At $t=0$, $x=0$ and $v=0$. (5)

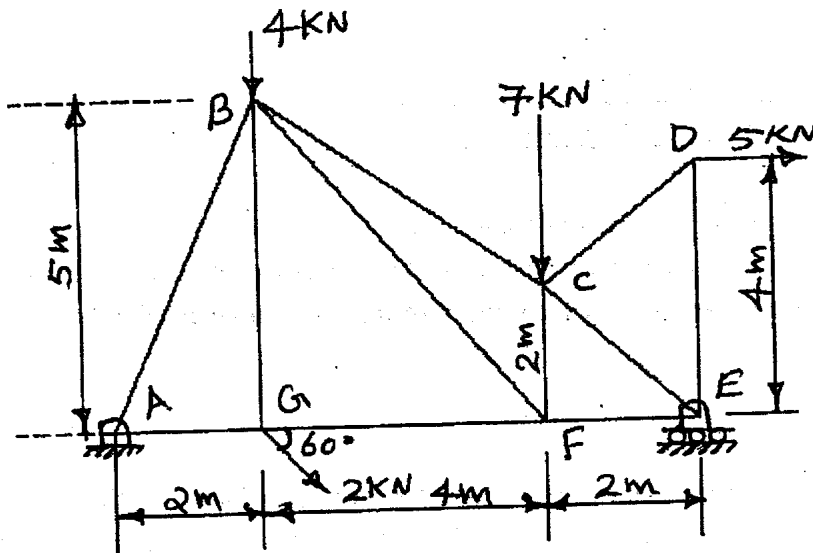
OR

Write short notes on Motion Curves. (5)

Q2. a) Determine the force P required to move the block A of weight 5000 N up the inclined plane. Coefficient of friction between all contact surfaces is 0.25. Neglect the weight of the wedge and the wedge angle is 15 degrees. (10)



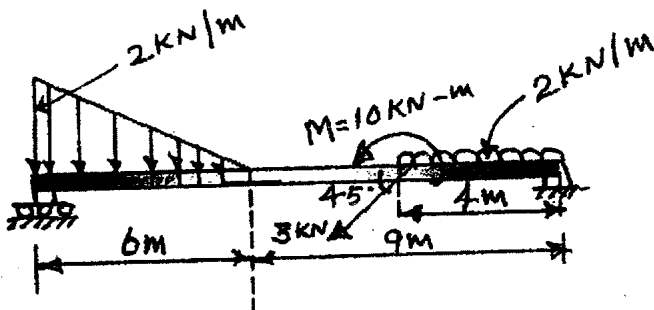
b. Refer the truss loaded as shown in the Figure. Determine (i) The reactions at the supports. (ii) Forces on members BC, BF, FG by Method of Section. (ii) Remaining member forces by Method Joints. (10)



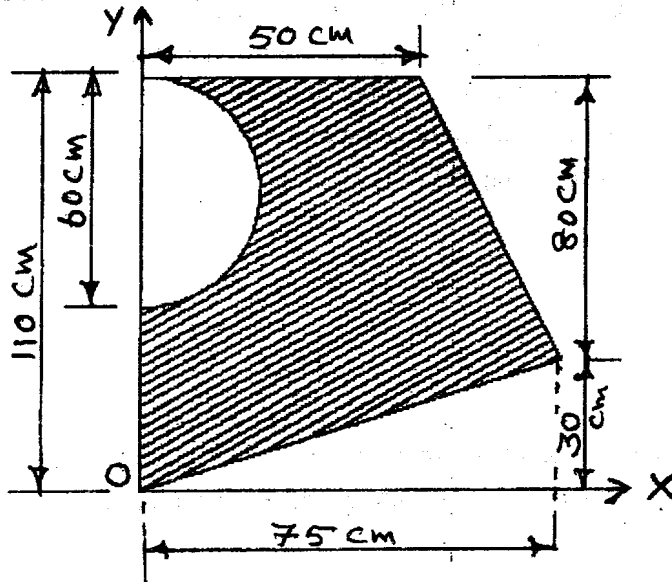
Q3) a) Derive An equation to find the centrifugal tension in a Belt Drive (4)

b) A leather Belt of width 200mm and thickness 10mm has a maximum permissible tension as 2×10^6 N/m². If the ratio of tension is 1.8, determine at what velocity should it be run so as to transmit maximum power? Also determine maximum value of power. Take mass of the belt material as 2.2 kg / m. (8)

c) Find the reactions at the supports of the Beam AB loaded as shown in the figure below. (8)



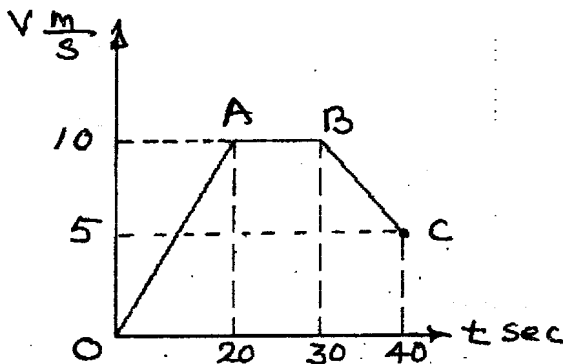
Q4) a). Find the Moment of Inertia of the shaded area about X and Y axis.



(8)

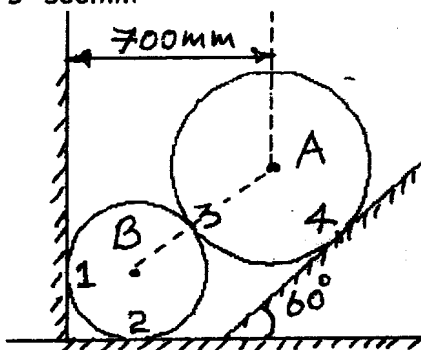
b)

Velocity -Time Graph for a particle moving along a straight line is given below. Draw Displacement- Time and Acceleration -Time graphs. Also find the Maximum Displacement of the Particle. (12)



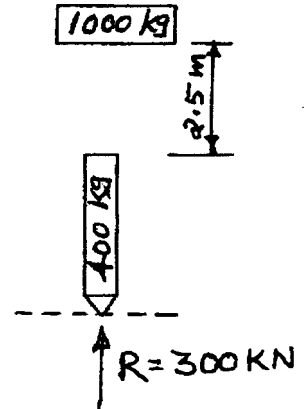
Q5) a). A ball is projected from the top of a tower of 110 m height with a velocity of 100 m/s and at an angle of elevation 25 degrees to the horizontal. Neglecting the air resistance find (1) The maximum height the Ball will rise from the ground (2) The horizontal distance it will travel just before it strikes the ground (3) the velocity with which it will strike the ground. (10)

b) Two spheres A and B of weight 1000N and 750 N respectively are kept as shown in the figure. Determine the reactions at all contact points 1,2,3 and 4. Rad. Of A = 400 mm & Rad. Of B = 300mm (10)



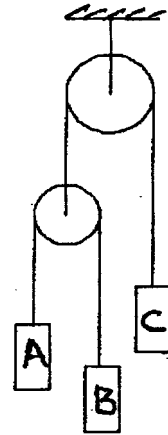
[TURN OVER

Q6) a) A pile of 400 Kg mass is being driven in to ground with the help of a hammer of mass 1000 Kg. Hammer falls through a height of 2.5 m. Assuming plastic impact between hammer and Pile, find the number of blows required to drive the pile by 1m when the resistance offered by the ground to penetration is 300 KN. (Refer the adjacent figure) (10)



b) The motion of a particle is defined by the position vector, $\vec{r} = 6t \mathbf{i} + 4t^2 \mathbf{j}$ where 'r' is in meters and 't' is in seconds. At the instant when $t=3$ seconds, find (i) Tangential and Normal components of accelerations (ii) Radius of curvature: (10)

Q7) a) Three weights A, B and C of weights 3Kg, 2Kg and 7Kg are connected as shown in the figure. Determine the accelerations of A, B and C. Also find the tension on the strings. (8)



(8)

b) Write short notes on Instantaneous center of Rotation. (4)

c) Rod AB of length 3m is kept on smooth planes as shown in the figure. The velocity of the end A is 5 m/sec. along the inclined plane. Locate the ICR and find the velocity of the end B (8)

