(3 Hours) **Marks :80**

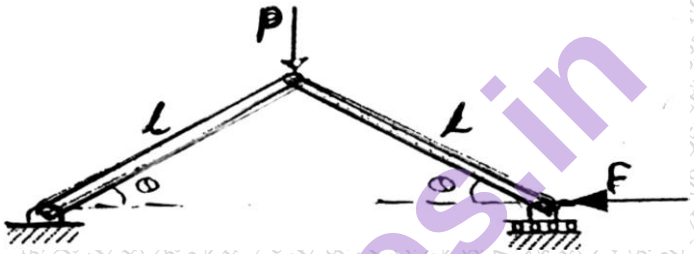
N.B. 1. Question No.1 is compulsory.
2. Answer any three questions from remaining questions.
3. Assume suitable data if required.
4. Figure to the right indicates full marks.
5. Take g= 9.81 m/s^2.

Q.1 Attempt any four. **20**

a) A force of a100 N act at a point P (-2, 3, 5)m has it line of action passing through Q (10,3, 4)m. Calculate the moment of force about origin.

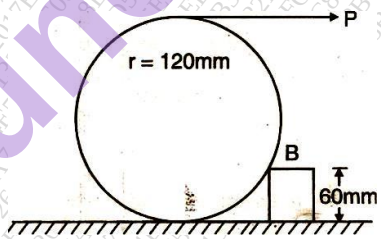
b) A vertical lift of total mass 750 kg acquires an upward velocity of 3 m/s over a distance of 4m moving with constant acceleration starting from rest. Calculate the tension in cable.

c) For the mechanism shown express the relation between forces F and P in terms of θ, by principle of virtual work.



d) A stone is released from top of the tower during the last second of its motion, it covers 1/4th of the height of the tower. Find the height of the tower.

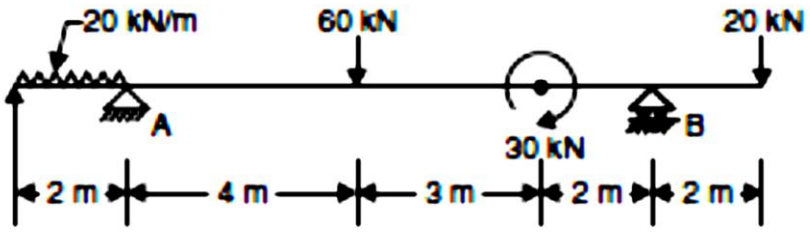
e) A roller of weight 500 N has a radius of 120 mm and is pulled over a step at height 60 mm by a horizontal force P. Find magnitude of P to just start the roller over the step.



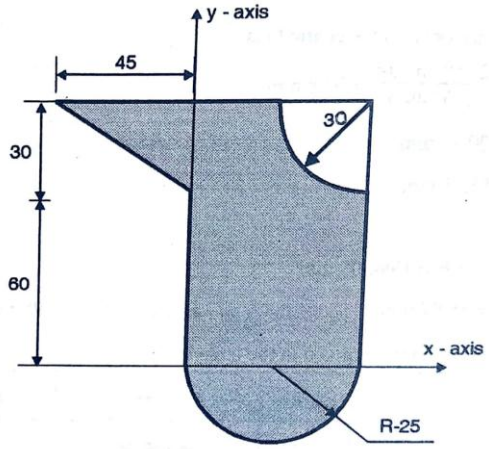
f) Classify types of motion for rigid body with suitable examples.

Q.2 a) State the laws of dry friction. **4**

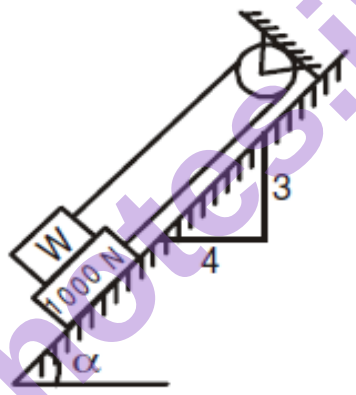
b) Find support reaction of the beam as shown in fig. **8**



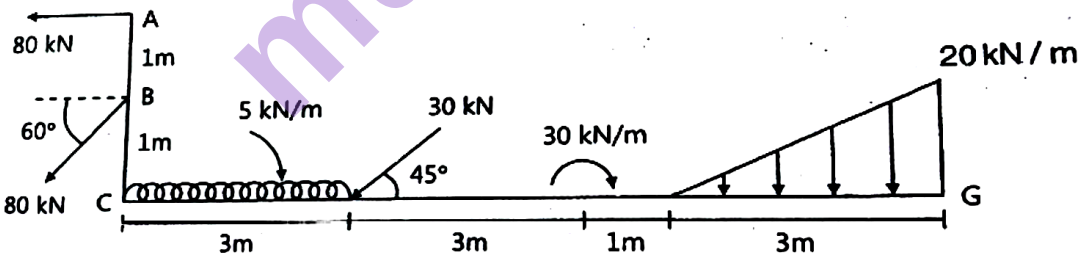
c) Find the coordinates of the centroid of the shaded area with respect to the axes shown in Fig. **8**



Q.3 a) In Fig. The frictionless fixed drum, and coefficient of friction between other surfaces of contact is 0.3. Determine the minimum weight W to prevent downward motion of the 1000 N body. **8**

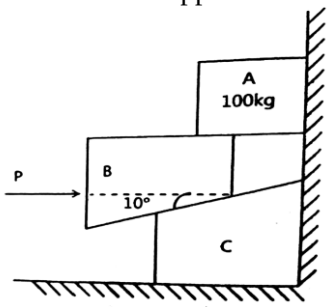


b) Determine the resultant of the given force system as shown in fig. **6**



c) An automobile starts from rest and travels on a straight path at 2 m/s^2 for some time. After which it deaccelerates at 1 m/s^2, till its comes to halt. If the distance covered is 300 m, find the maximum velocity of the automobile and the total time of travel. **6**

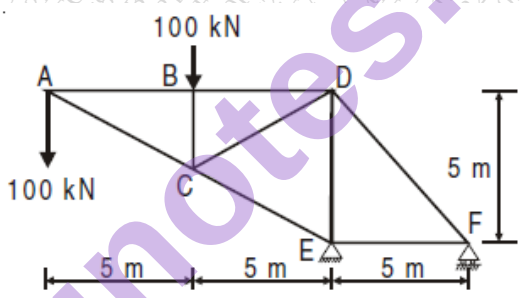
Q.4 a) Two 10^0 wedges of negligible weight are used to just move the block of mass 100 kg. If $\mu = 0.25$ at all surfaces of contact. Find the force P that should be applied on the wedge. **8**



b) State and derive Work Energy principle. **4**

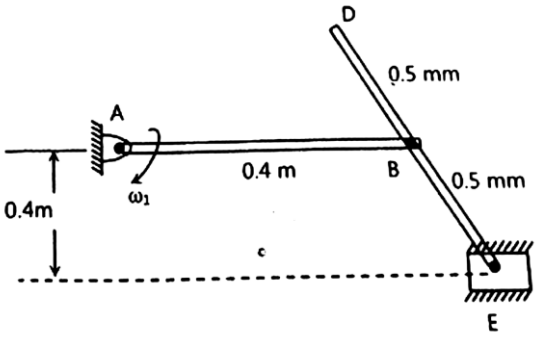
c) Find the initial velocity and corresponding angle of projection of a projectile such that when projected from the ground it just clears a wall 4.5 m high at a horizontal distance of 6 m and finally lands on the ground at a distance of 35 m beyond the wall. **8**

Q.5 a) Referring to the truss shown in figure, find: **8**
(a) Support Reactions. .
(c) Forces in members BD, CD and CE by method of sections.
(d) Forces in other members by method of joints.

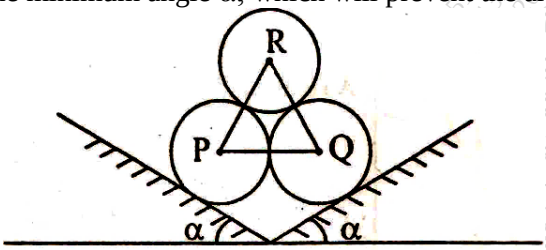


b) Two balls of the masses 10 kg and 20 kg are moving along a straight line towards each other at velocities of 4 m/s and 1 m/s respectively. If e=0.6, determine the velocities of the balls just after collision. **6**

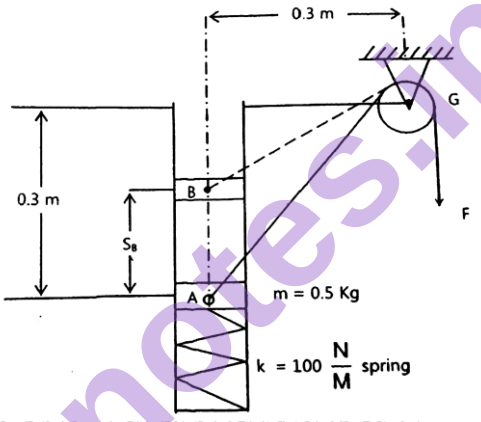
c) For the position shown, the angular velocity of bar AB is 2.8 r/s clockwise if AB is a horizontal. Determine the velocities of slider E and point D. **6**



Q.6 a) Three identical spheres P, Q and R each of weight W are arranged on smooth inclined surface are shown in Fig. Determine the minimum angle α, which will prevent the arrangement from collapsing. **8**



b) The block of amass 0.5 kg moves within the smooth vertical slot. If its start from rest, when the attached spring is in the upstretched position at A. determine constant vertical force F which must be applied to the cord, so that block attains a speed of 2.5 m/s when it reaches B. i.e., S_B = 0.15 m, neglect the mass of the cord, pulley and friction between cord and pulley. **6**



c) A car is moving on a curve of radius 300 m at a speed of 90 kmph. The brakes are suddenly applied, causing speed to decrease at a constant rate of 1.3 m/s^2. Determine the total acceleration immediately after brakes have been applied. **6**
