**Registration no:** | | | | | | | | | | |

**Total Number of Pages: 04**

**B.Tech**
**BE2104**

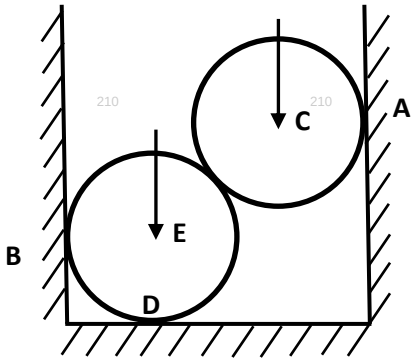
# 2nd Semester Back Examination 2015-16
## MECHANICS
### BRANCH: ALL
### Time: 3 Hours
### Max Marks: 70
### Q.CODE: W621

**Answer Question No.1 which is compulsory and any five from the rest.**
**The figures in the right hand margin indicate marks.**

**Q1** Answer the following questions: **(2 x 10)**

**a)** State and explain theorem of transmissibility with a neat sketch.

**b)** Draw the free body diagram of the problem taking both the roller as a single system.




**c)** While analyzing a truss by method of section, the truss is cut in two parts by an imaginary section preferably cutting not more than three members. What is the reason for this?

**d)** Give two examples of application of Pappus theorem I and II.

**e)** State and explain principle of virtual work with a neat sketch.

**f)** Differentiate between coefficient of static and kinetic friction.

**g)** The acceleration of a body starting from rest and moving along a straight line is given by a = t/30 + 2/3 where a is in $m/s^2$ and t in seconds. Obtain the velocity at t =10 s.

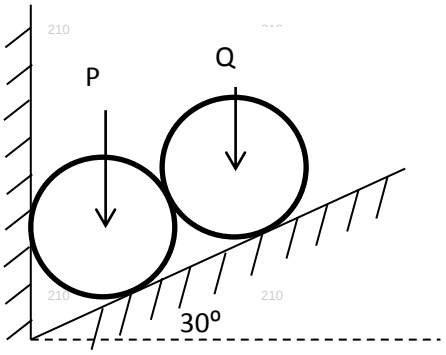
**h)** State the principle of impulse-momentum.

**i)** A force P = 10x is acting on a particle of mass 5kg, where x is the displacement in m. If the particle starts from rest, find the velocity at x = 25 m.

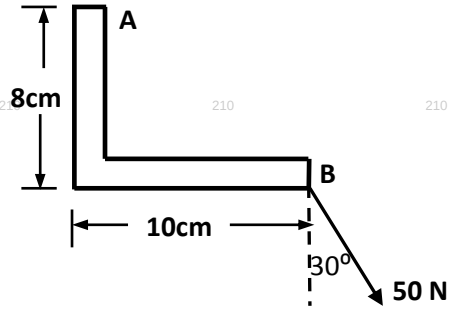
**j)** At a given instant a shaft is rotating at 50 rpm about a fixed axis and 20 s later, it is rotating at 1050 rpm. Determine the average angular acceleration in $rad/s^2$.

**Q2** **a)** Two spheres P = 200 N and Q =150 N are kept within a conical channel as shown in the figure. All contact surfaces are smooth. Determine all contact reactions. Sizes of the spheres are same, but **(7)**

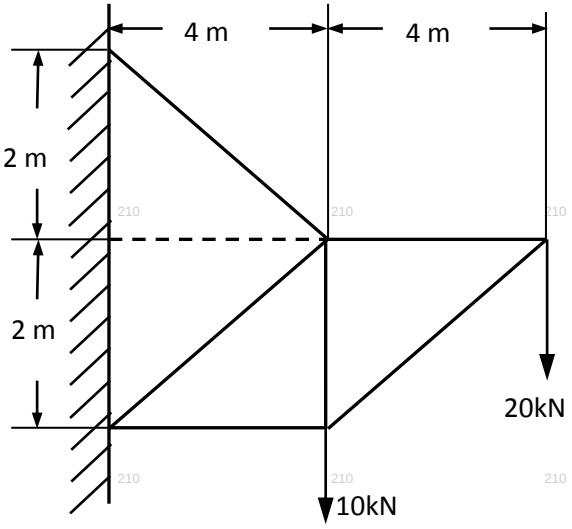
have different weights.




**b)** A 50N force is applied to a corner plate at B as shown in the figure. Determine an equivalent force couple system acting at A. **(3)**

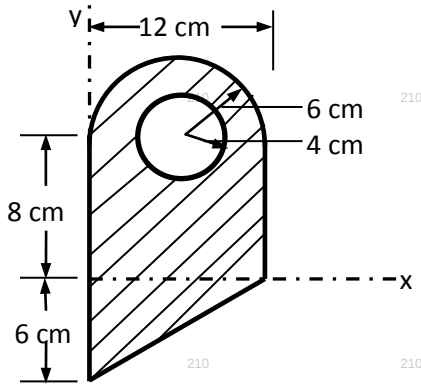



**Q3** Determine the force in each member of the truss as shown in the figure. **(10)**




**Q4** **a)** A uniform ladder of length 10 m weighing 20 N is placed against a smooth vertical wall with its lower end 4 m from the wall. The coefficient of friction between the ladder and the floor is 0.3. Check whether or not the ladder will remain in equilibrium in this position. **(5)**

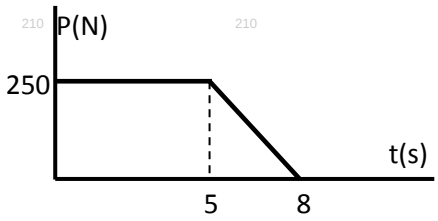
**b)** For the plane area shown, find the position of the centroid of the shaded area. **(5)**




**Q5** **a)** A ball was thrown vertically upward from a point on a tower located 25 m above the ground. The ball strikes the ground 3 s after release. Determinr the speed with which the ball (i) was thrown upward, (ii) strikes the ground. **(5)**

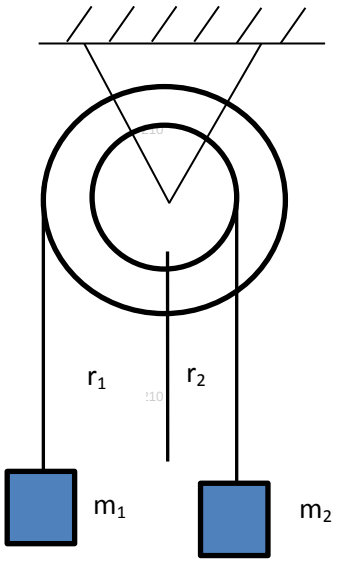
**b)** A racing car travels around a circular track of 300 m radius with a speed of 300 kmph. What angle $\alpha$ should the floor of the track make with the horizontal in order to safeguard against skidding? **(5)**

**Q6** **a)** A 50kg block placed on a horizontal rough surface and initially at rest is acted upon by a force P which varies as shown in the figure. The kinematic friction is 0.20. Determine the velocity of the block after (i) t = 5s and (ii) t =5s. **(7)**



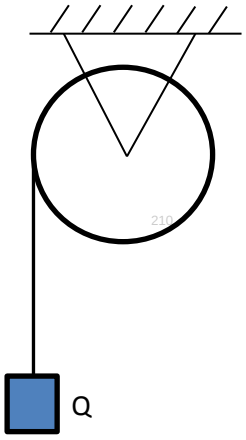

**b)** A 2000 kg rail car moving at a speed of 0.5m/s to the right collides with a 3500 kg car which is at rest. If after the collision the 3500 kg car is observed to move to the right at a speed of 0.3 m/s, determine the coefficient of restitution. **(3)**

**Q7** **a)** Considering the inertial and frictional effect absent in the pulley system as shown, determine the downward acceleration of mass $m_1$, Take $m_1$ = 8kg, $m_2$ = 12kg, $r_1 = r_2$ = 20cm. **(7)**



**b)** A rocket is released from a jet fighter flying horizontally at 1200 kmph at an altitude of 3000m above the target. The rocket thrust gives it a constant horizontal acceleration of 6m/sec$^2$. At what angle below the horizontal should pilot see the target at the instant of releasing the rocket in order to score a hit? **(3)**

**Q8** **a)** A solid right circular drum of radius r = 0.5m and weight W = 200N is free to rotate about its geometric axis as shown in the figure. Wound around the circumference of the drum is a flexible cord carrying at its free end a weight Q = 50N. If the weight Q is released from rest, find the time t required to fall a height of h =2m. **(7)**




**b)** An automobile weighing 2000N is driven down $5^0$ incline at a speed of 90kmph when the brakes are applied causing a total braking force of 750N. Determine the distance travelled by the automobile as it comes to a stop. (3)