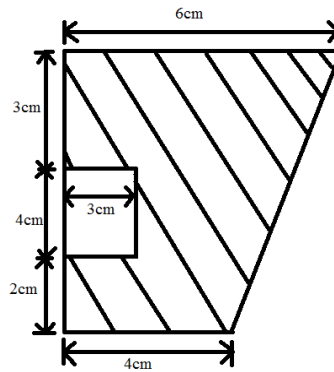




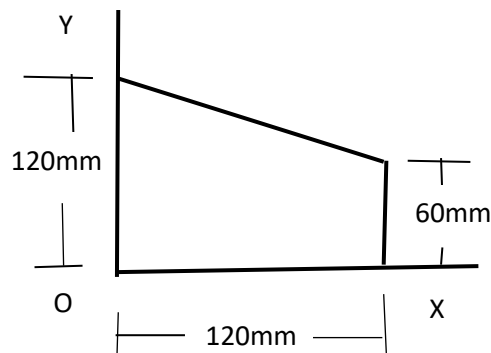


at the level of floor. Find the minimum horizontal force in this condition.

- 13 a) Define principal axes and principal moment of inertia. (4)  
 b) Determine the centroid of the shaded area. Also find moment of inertia of the shaded area about an horizontal axis passing through the centroid. (6)



- 14 a) Determine the product of inertia about OX and OY of the trapezium. (5)

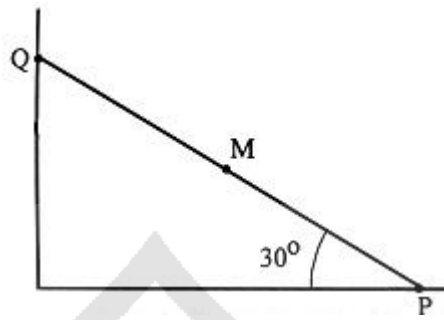


- b) A simply supported beam of span 6 m is loaded with a concentrated load of 5kN at a distance of 1 m from left end. The beam is also loaded with a uniformly distributed load of 2kN/m length over a distance of 4m from the right end of the beam. Find the reactions at the supports of the beam using principle of virtual work. (5)

### SET III

(ANSWER ANY 2 QUESTIONS: 2 X 10 = 20 MARKS)

- 15 a) With neat sketches differentiate between motion of translation and motion of rotation. (4)  
 b) A bar PQ of length 1m has its end Q constrained to move horizontally and the other end P constrained to move vertically as shown in the figure given below. The end P moves horizontally with a constant velocity of 5 m/s. The bar makes an angle of  $30^\circ$  with the horizontal. Find the angular velocity of the bar and the velocity of end Q and M. (6)



- 16 A clock provided with a seconds pendulum is gaining 160 seconds a day. Find by how much the length of the pendulum should be increased so as to correct the clock. If it is running at correct time at a place where acceleration due to gravity is  $9.81 \text{ m/s}^2$ , find by how much the clock will lose or gain if it is taken to a place where the acceleration due to gravity is  $9.79 \text{ m/s}^2$ . (10)
- 17 A helical spring under a weight of 20 N extends by 0.3 mm. A weight of 700 N is supported on the same spring. Determine the period and frequency of vibration of the spring when they are displaced vertically by a distance of 0.9 cm and released. Find the velocity of the weight when the weight is 4 mm below its equilibrium position. Take the weight of spring as negligible. (10)

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