



Reg. No. : .....

Name : .....

**Combined First and Second Semester B.Tech. Degree Examination, December 2016 (2013 Scheme)**

**13.105 : ENGINEERING MECHANICS (ABCEFHMNPRSTU)**

Time : 3 Hours

Max. Marks : 100

**PART - A**

Answer **all** questions. **Each** question carries **4** marks.

1. Explain the theorem of transmissibility of a force. What is its limitation ?
2. What is a "free body diagram" ? Explain with at least two examples.
3. List the different types of supports. Sketch their free body diagrams.
4. State the law of conservation of momentum.
5. Distinguish between centrifugal and centripetal forces. (5x4=20 Marks)

**PART - B**

Answer **one** question from **each** Module. **Each** question carries **20** marks.

**Module - I**

6. a) A 20 kg lamp is supported by two cables AB and AC as shown in Figure 1.

Find the tension in each cable.

10

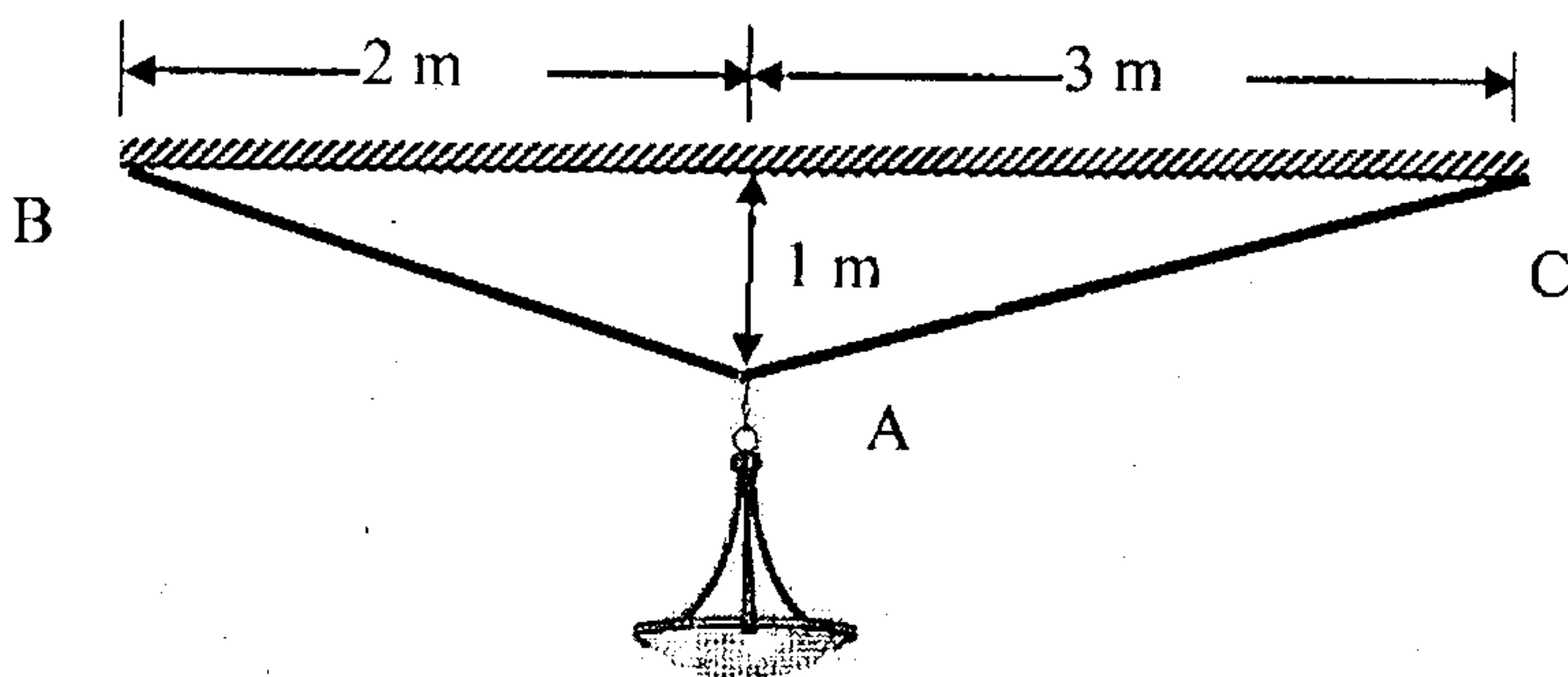


Fig. 1

b) Find the magnitude and position of the resultant of the system of forces shown in Fig. 2.

10

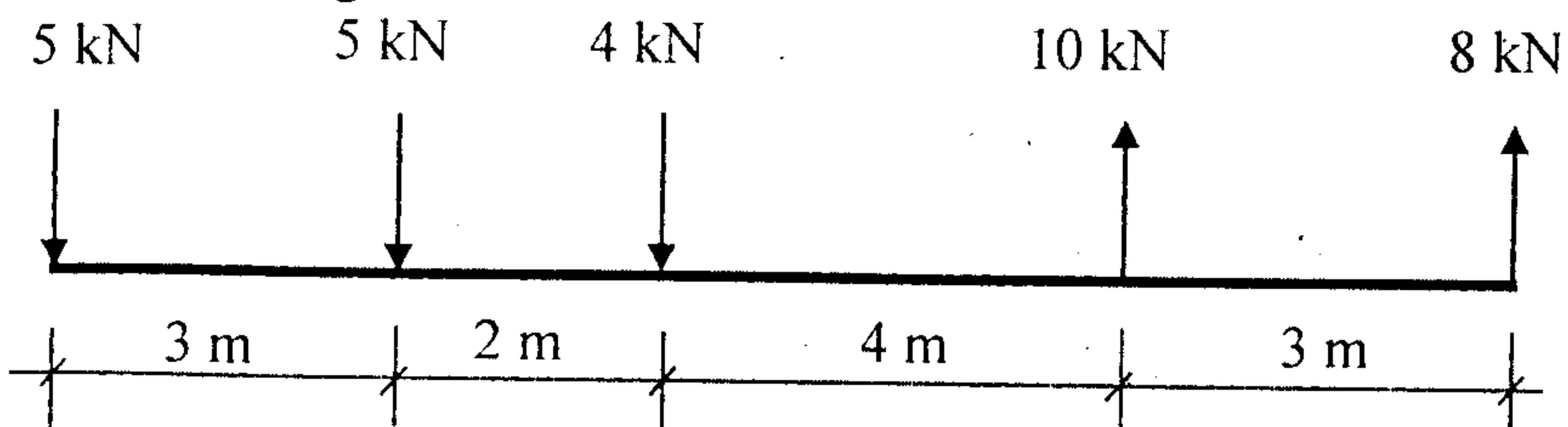


Fig. 2

OR

P.T.O.



7. A system of forces acts as shown in Fig. 3. Find the magnitude of P and Q, so that the resultant of the force system passes through points A and B.

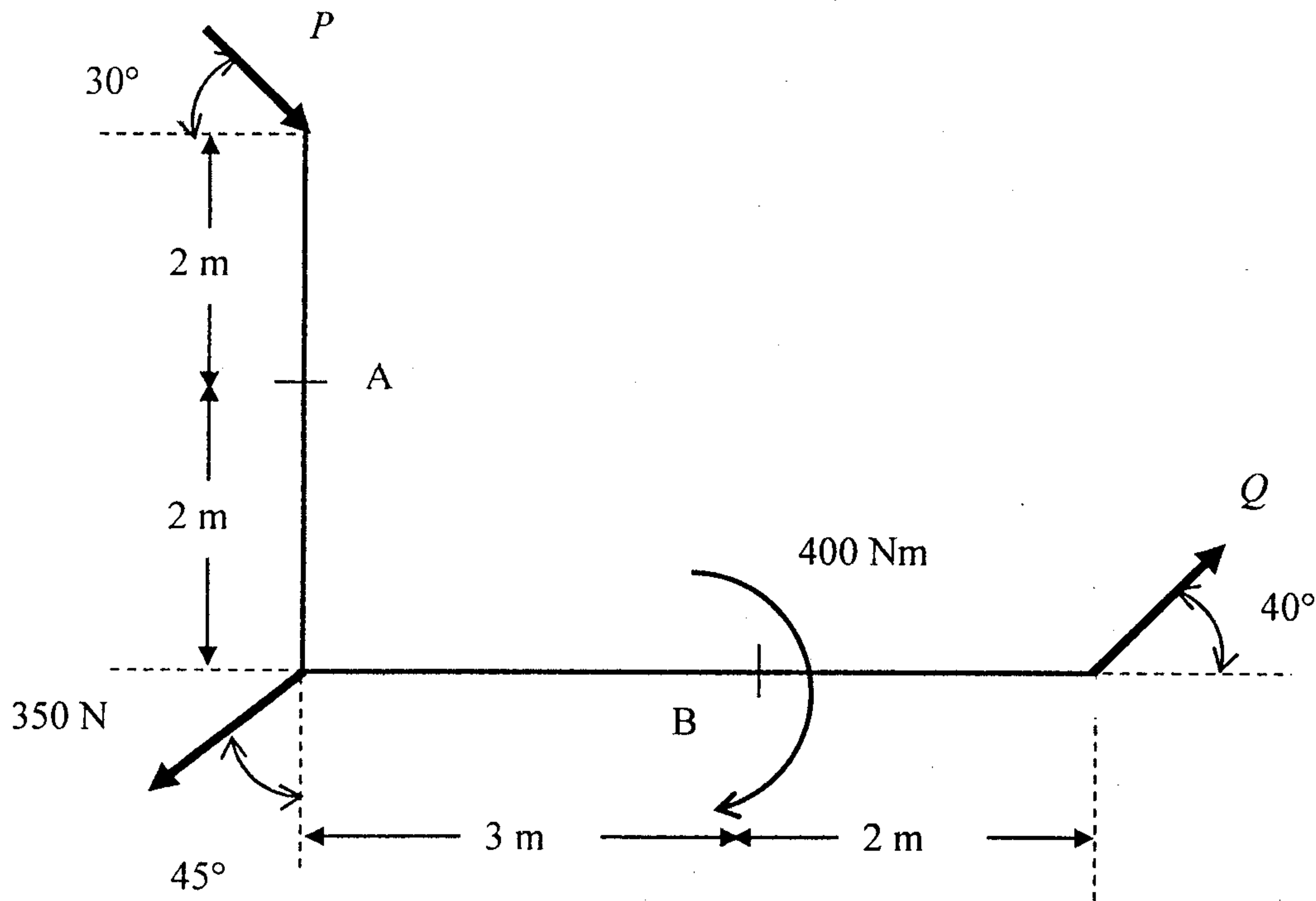


Fig. 3

**Module – II**

8. Referring to Figure 4, the coefficients of friction are as follows : 0.20 at the floor, 0.25 at the wall and 0.15 between the blocks. Find the minimum value of horizontal force P to be applied to the lower block that holds the system in equilibrium.

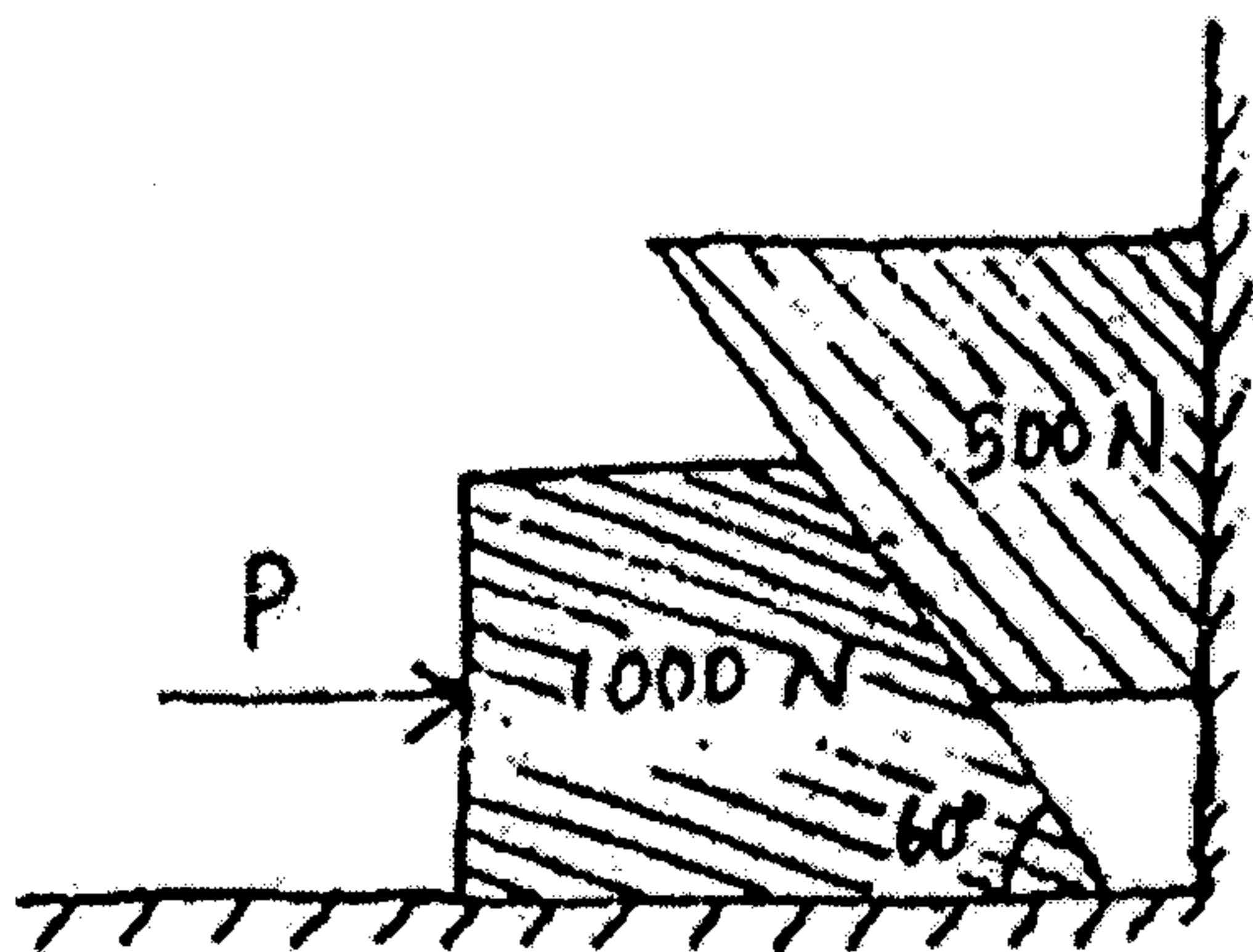


Fig. 4

OR



9. For the shaded area shown in Figure 5, determine second moment of area about MM axis.

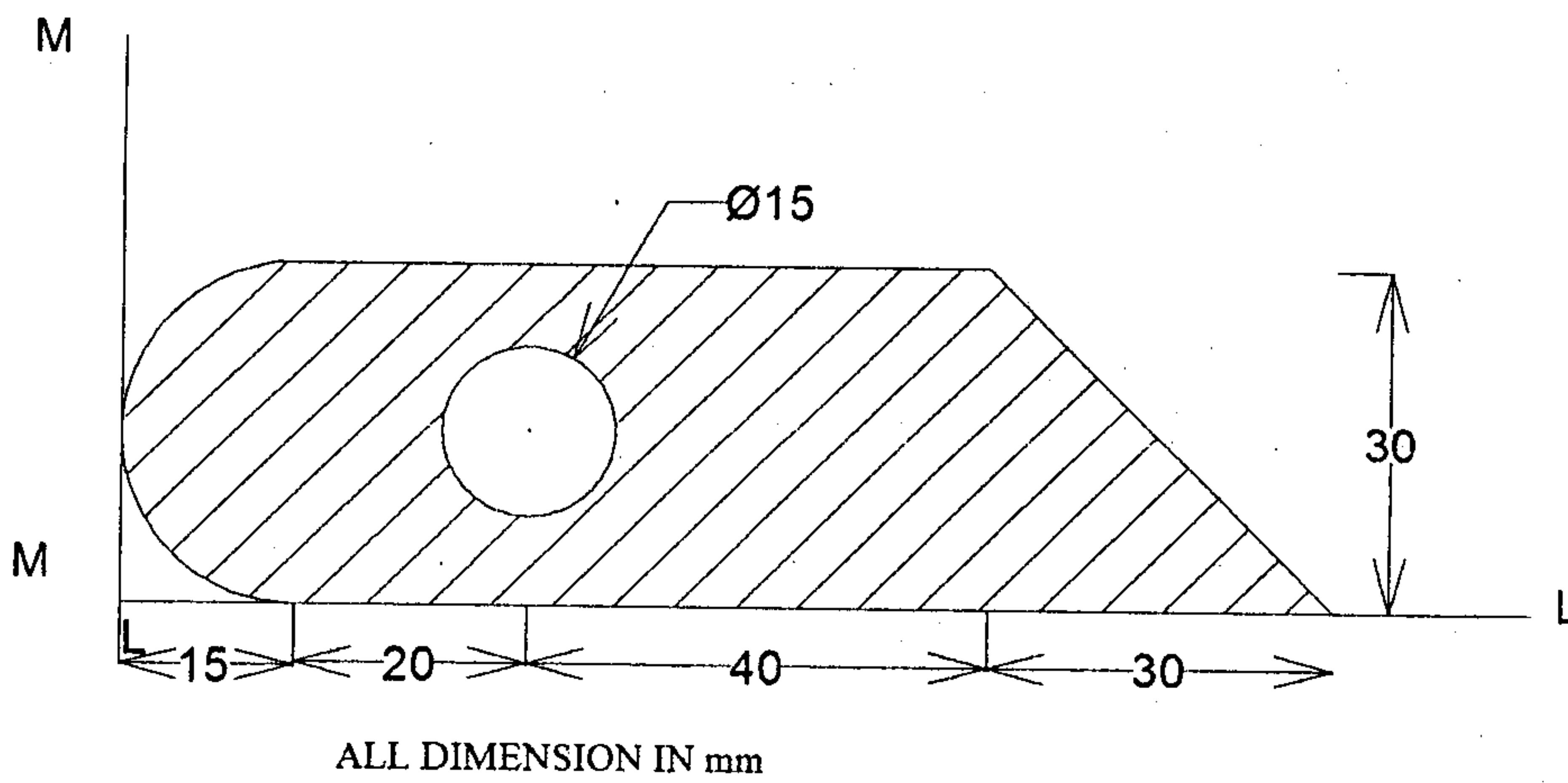


Fig. 5

**Module – III**

- 10. a) What is impulsive force and impulsive motion ? 5
- b) A block and pulley system is shown in Fig. 6. The coefficient of kinetic friction between the block and the plane is 0.2. Assume the pulley to be frictionless. Find the acceleration of the blocks and the tension in the string when the system is just released. Also find the time required for 250 kg block to come down by 3 m. 15

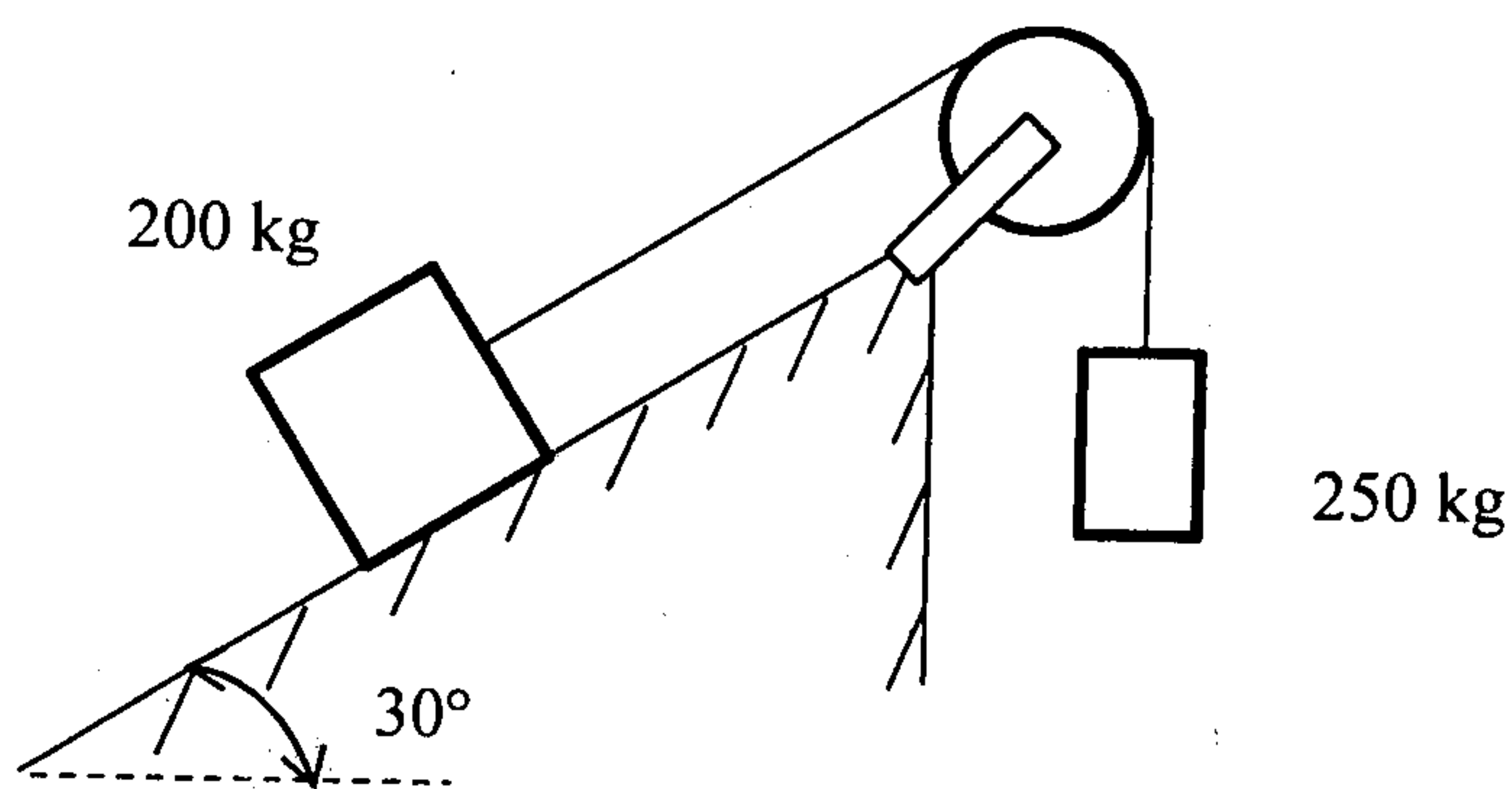


Fig. 6

OR



11. The magnitude and direction of velocities of two smooth balls before they strike each other is as shown in Figure 7. If  $e = 0.9$ , determine the magnitude and direction of the velocities of each ball after impact.

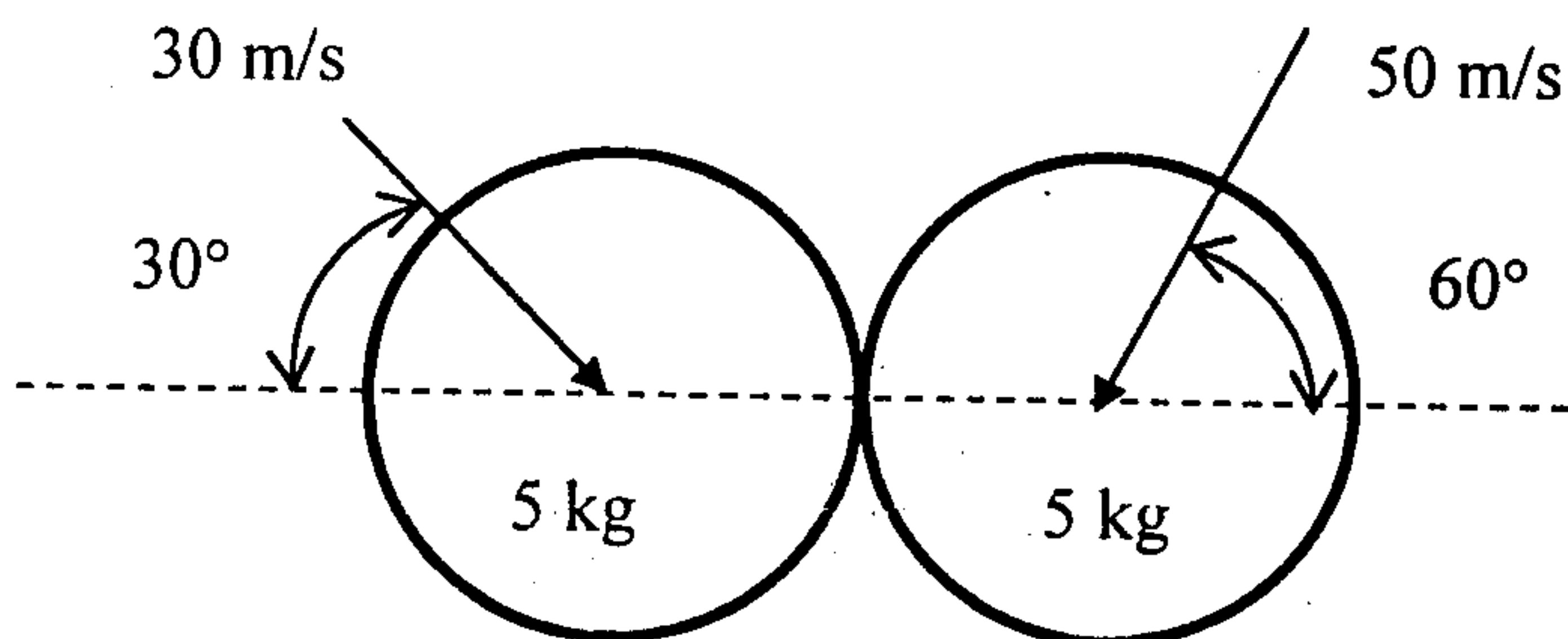


Fig. 7

### Module – IV

12. In the engine system shown in Figure 8, the crank PQ has a constant angular speed of 2800 rpm. For the crank position indicated,

Find :

- The angular velocity of the connecting rod QR, and
- Velocity of the piston R.

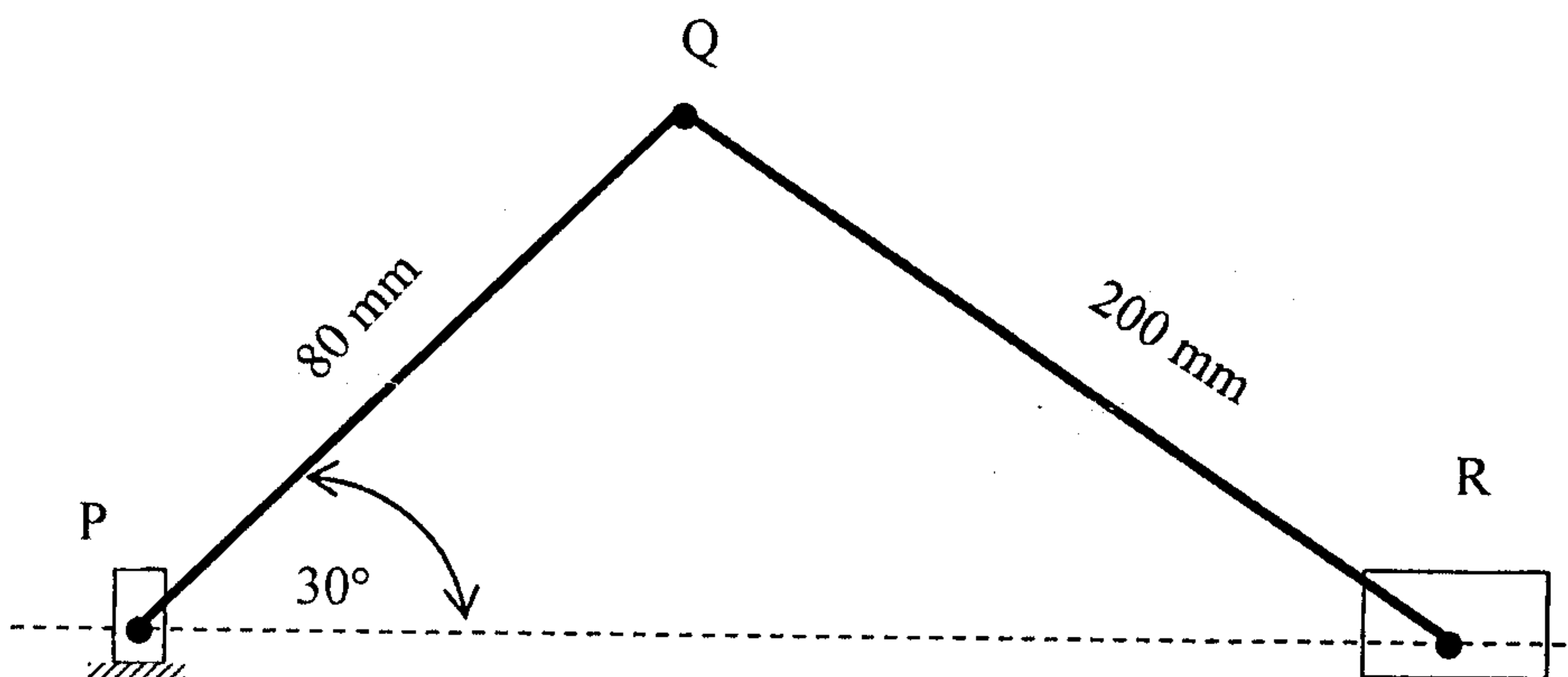


Fig. 8

OR

13. Derive the equation of motion of a simple pendulum of length  $l$  and hence determine its natural frequency and period of vibration. **(4×20=80 Marks)**

