

22203

22223

3 Hours / 70 Marks

Seat No.

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- Instructions* –
- (1) All Questions are *Compulsory*.
 - (2) Answer each next main Question on a new page.
 - (3) Illustrate your answers with neat sketches wherever necessary.
 - (4) Figures to the right indicate full marks.
 - (5) Assume suitable data, if necessary.
 - (6) Use of Non-programmable Electronic Pocket Calculator is permissible.
 - (7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

- 1. Attempt any FIVE of the following:** **10**
 - a) Write classification of force system.
 - b) Define load lost in friction.
 - c) Define beam and state the types of beam.
 - d) Define equilibrant.
 - e) Define coefficient of friction.
 - f) Define centroid and centre of gravity.
 - g) State Lami's theorem.

- 2. Attempt any THREE of the following:** **12**
 - a) Define force and state the characteristics of a force.
 - b) In a machine load of 500 N was lifted by an effort 50 N. Another load of 750 N was lifted by an effort 60 N. Obtain law of machine.
 - c) Explain law of machine. State its use.
 - d) State four laws of static friction.

P.T.O.

3. Attempt any THREE of the following: 12

- State law of parallelogram of forces with sketch and state its limitations.
- Two forces of magnitude 100 N pull and 80 N push are acting at a point making an angle of 135° between them. Find the resultant in magnitude and direction.
- In differential axle and wheel the diameter of the wheel is 40 cm and diameters of axle are 10 cm and 8 cm. If an effort of 50 N can lift a load of 1500 N. Find the efficiency of the machine and effort lost in friction.
- Certain machine has a law of machine $p = (0.025 w + 20)$ N with $V_R = 60$, calculate its efficiency at a load of 1 kN.

4. Attempt any THREE of the following: 12

- Find the algebraic sum of moments of all forces as shown in Fig. No. 1. about the point 'C' consider $AB = BC = AC = 2\text{m}$.

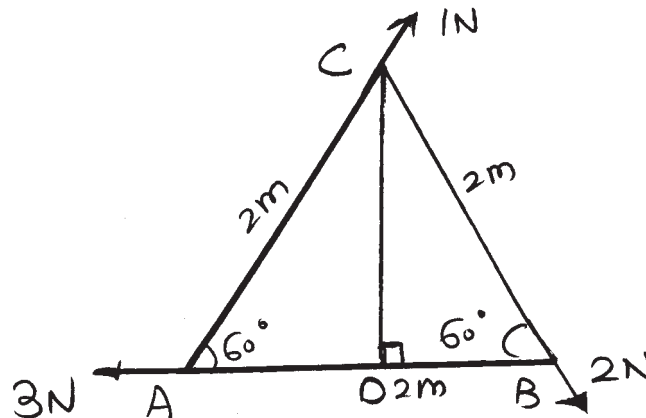


Figure No. 1.

- A sphere of weight 450 N rests in a groove of smooth inclined surfaces which are making 60° and 30° inclination with horizontal. Find the reactions at the contact surfaces.
- A beam AB, 6 m long rests on two supports 4 m apart the right hand end is overhanging by 2 m, the beam carries a udl of 4 kN/m, over entire span. Determine the reactions of supports.
- A body of weighting 12 kN is lying on a horizontal plane for which $\mu = 0.70$. Determine normal reaction limiting force of friction. Horizontal force required to move it and angle of friction.

- e) Calculate magnitude of force P and tension in the wire OA , if an electric bulb of weight 20 N hangs vertically from a ceiling as shown in Fig. No. 2.

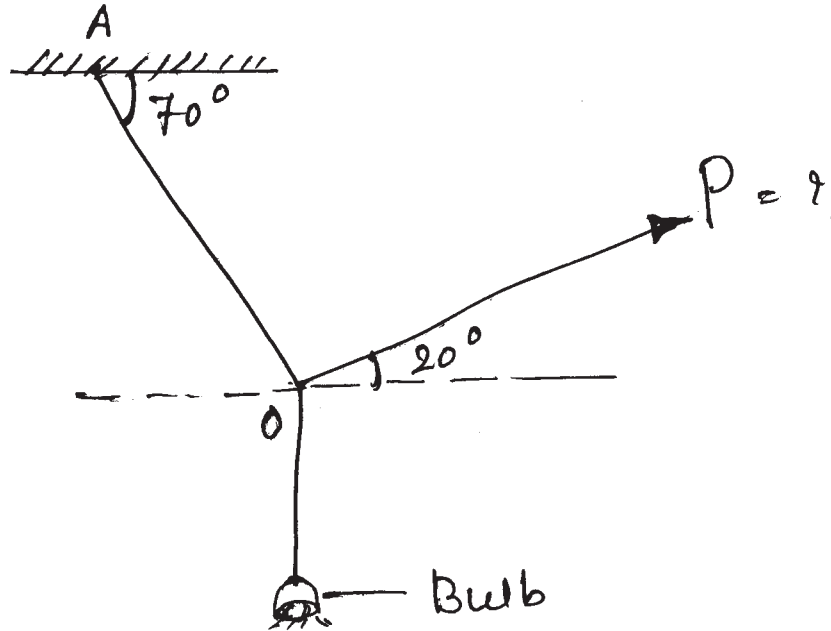


Figure No. 2.

5. Attempt any TWO of the following:

12

- Calculate the reactions of support by graphical method for Q. No. 4 (c).
- A block having weight of 400 N just start moving down the plane making an angle of 35° with the horizontal due to its own weight. Calculate the force applied parallel to the plane to keep the block in equilibrium $\mu = 0.25$.
- Locate graphically the positions of resultant for the parallel force system, as shown in Fig. No. 3. w.r.t. to point A.

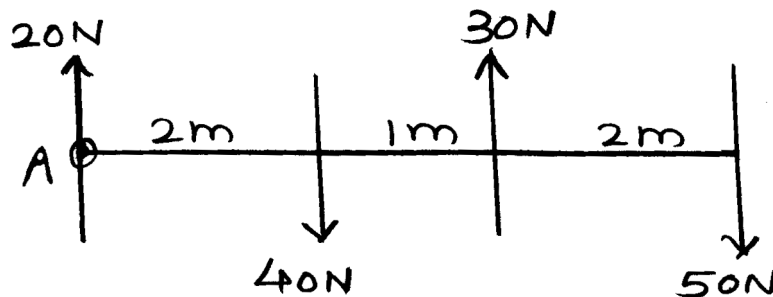


Figure No. 3.

P.T.O.

6. Attempt any TWO of the following:

12

- a) Find the positions of centroid of an unequal angle section with dimension $200 \times 150 \times 10$ mm. longer led is vertical.
- b) Locate centroid of shaded area as shown in Fig. No. 4.

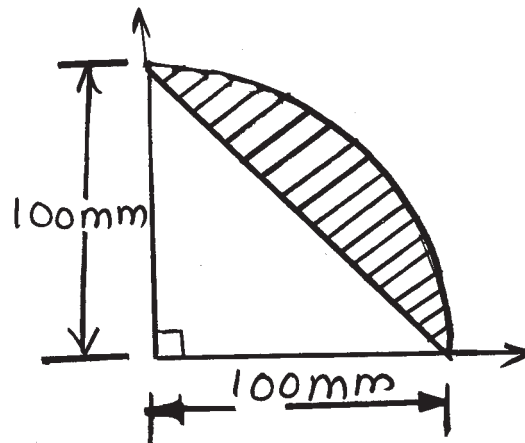


Figure No. 4.

- c) A right circular cone of base diameter 100 mm and height 200 mm is placed on the hemisphere of the same diameter. Calculate its CG. Refer Fig. No. 5.

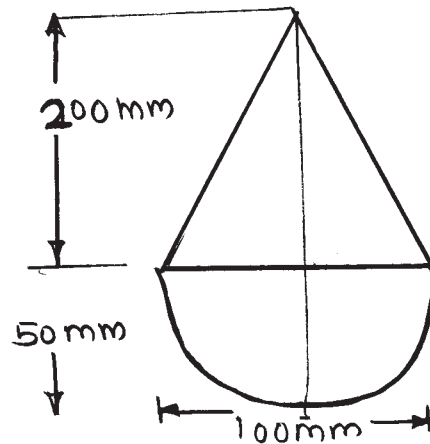


Figure No. 5.