

# 22203

**11920**

**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) Define scalar quantity and vector quantity.
  - b) State V.R. of geared pulley block.
  - c) State law of polygon of forces.
  - d) Define free body diagram.
  - e) State four laws of static friction.
  - f) State the centroid of semi-circle and show it on the sketch.
  - g) State two limitations of Lami's theorem.

P.T.O.

2. Attempt any THREE of the following: 12

- Define force system. Explain three force systems with sketches.
- For a certain machine, VR is 125. To lift a load of 11.90 kN, an effort of 190 N is required. Calculate the effort required to lift a load of 72 kN and identify the type of machine.
- State law of machine and explain its significance.
- State four laws of static friction.

3. Attempt any THREE of the following: 12

- Calculate the magnitude and direction of resultant for the concurrent force system on shown in Figure No. 1. Show it on the sketch. Use analytical method only.

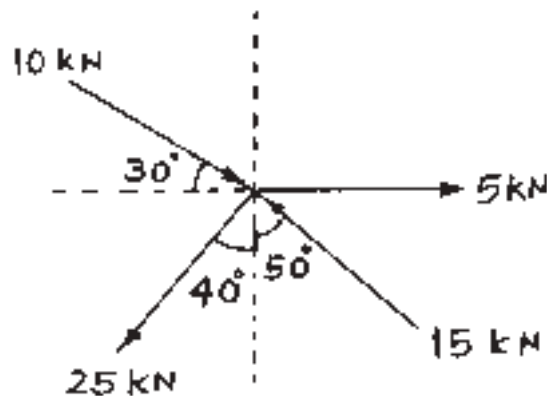


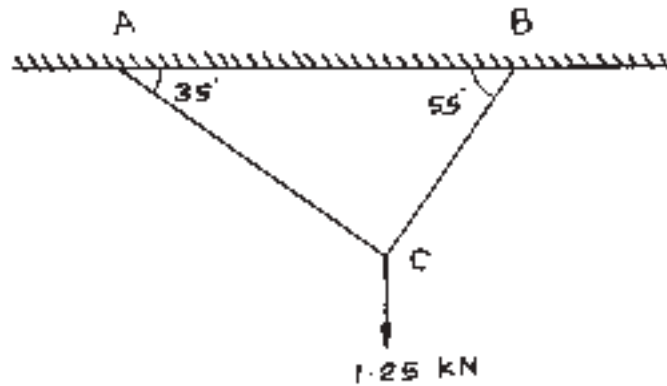
Fig. No. 1

- State law of polygon of forces and explain it with sketch.
- In a worm and worm wheel, the number of teeth on the worm wheel is 120. The diameter of effort wheel is 100 mm and that of loading drum is 150 mm. This worm and worm wheel lifts a load of 2.5 kN by applying 100 N effort. Calculate efficiency and effort lost in friction.
- A machine lifts a load of 19 kN and 29 kN by efforts of 700 N and 900 N respectively. Calculate the law of machine and efficiency of a load of 50 kN if V.R. is 50.

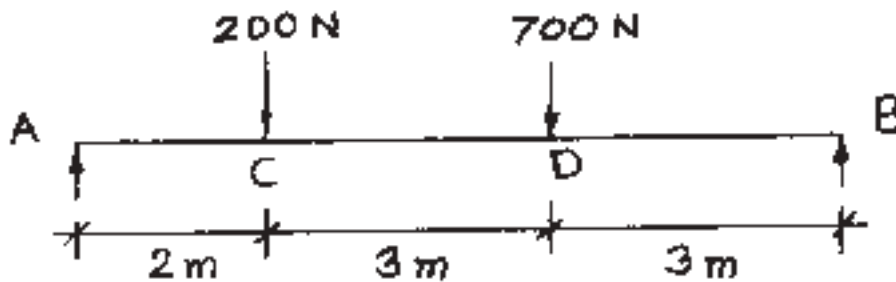
4. Attempt any THREE of the following:

12

- a) Calculate the resultant of two concurrent forces of magnitudes of 25 kN and 50 kN with included angle of  $55^\circ$ .
- b) A weight of 1.25 kN is attached by two ropes as shown in Figure No. 2. Calculate the tension in the ropes.

Fig. No. 2

- c) A beam is loaded as shown in Figure No. 3. Calculate its support reactions using graphical method only.

Fig. No. 3

- d) A body weighing 250 N is resting on a rough horizontal plane and is just moved by a horizontal force of 100 N. Calculate coefficient of friction. Also calculate magnitude and direction of the resultant reaction.
- e) A sphere having diameter 350 mm and 750 kN as weight is placed as shown in Figure No. 4. Calculate the reaction at point of contacts.

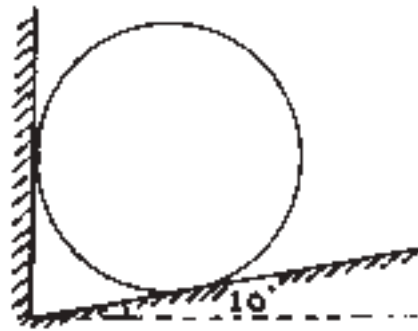


Fig. No. 4

5. Attempt any TWO of the following:

12

- a) Calculate the support reactions of beam loaded as shown in Figure No. 5. Use analytical method only.

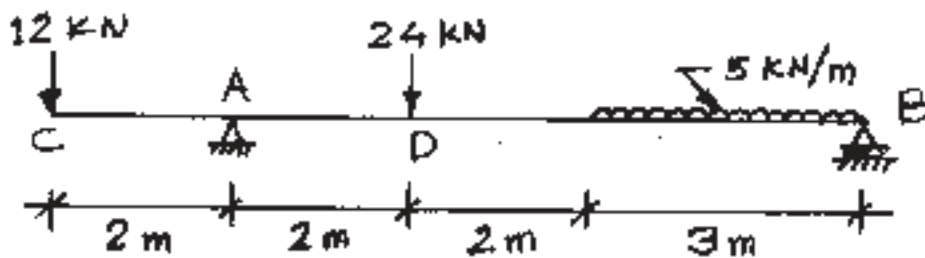


Fig. No. 5

- b) A block is resting on a rough inclined plane whose inclination to the horizontal is  $15^\circ$ . The force of 11 N applied parallel to the plane on which block is resting will just move it down. If the coefficient of friction between the block and the plane is 0.40, estimate the weight of the block.

- c) Calculate the magnitude and direction of a resultant force for a force system as shown in the Figure No. 6. Locate it with respect to point A.

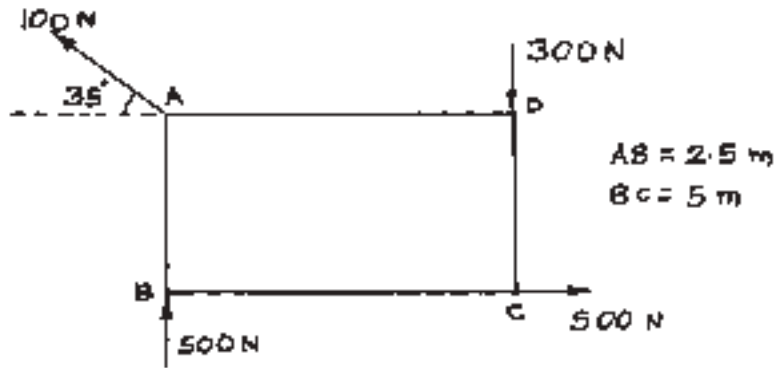


Fig. No. 6

6. Attempt any TWO of the following:

12

- a) Locate the centroid of a lamina as shown in Figure No. 7

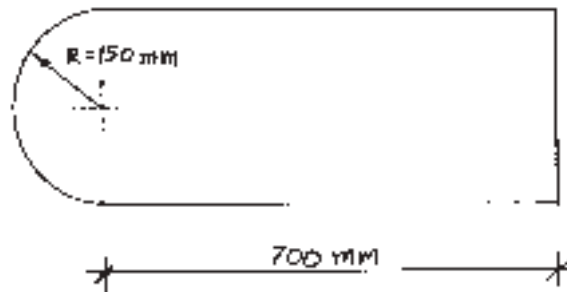


Fig. No. 7

- b) Locate the centroid of a shaded portion of a lamina as shown in Figure No. 8

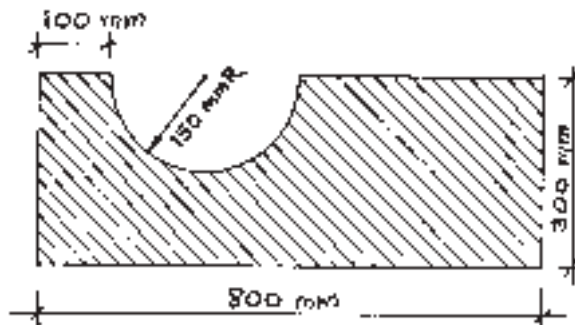


Fig. No. 8

P.T.O.

- c) Locate the center of gravity for the solid as shown in Figure No. 9

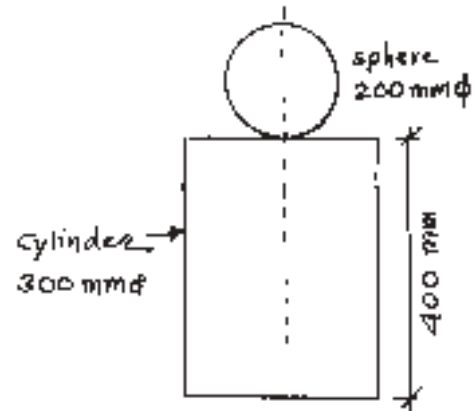


Fig. No. 9