

# 22203

**23242**

**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 Statics and Dynamics.
  - b) Define efficiency of the machine.
  - c) State law of parallelogram of forces.
  - d) State analytical conditions of equilibrium for coplanar force system.
  - e) Define coefficient of friction and angle of friction.
  - f) Locate the position of C.G. for hemisphere having 400 mm as diameter.
  - g) Write any two types of loading on a beam with sketch.

P.T.O.

2. Attempt any THREE of the following: 12

- a) Write any four characteristics of a couple.
- b) A machine has V.R. 60. A load of 4kN is lifted by an effort of 160N. Calculate M.A., efficiency, ideal effort and effort lost in friction.
- c) Draw nature of graph for
  - i) Load  $\times$  Effort
  - ii) Load  $\times$  M.A.
- d) Write law of friction and explain terms.

3. Attempt any THREE of the following: 12

- a) Calculate the magnitude and direction of resultant force of the force system shown in **Fig. No. 1** by analytical method.

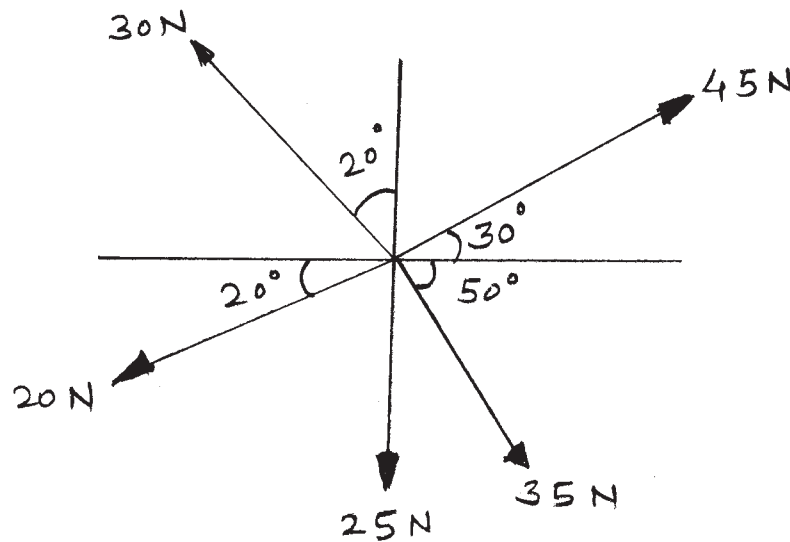


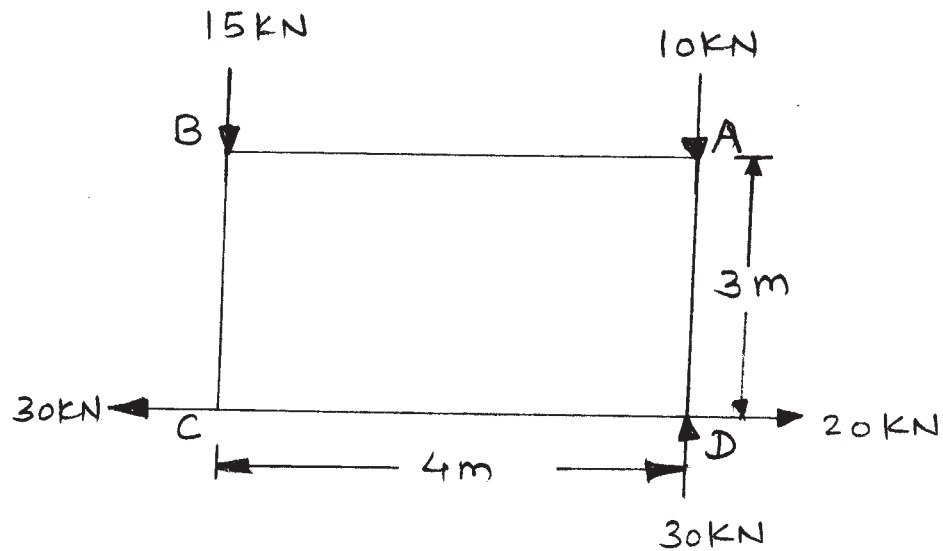
Fig. No. 1

- b) Define moment of a force. State its S.I. unit and sign conventions.
- c) In a lifting machine a load of 20kN is raised by effort of 500N. If the efficiency of the machine is 75%. Calculate M.A. and V.R. If the machine lifts 30kN load by effort of 800N. Find the law of machine.
- d) A load of 1400 N can be lifted by an effort of 40N in a differential axle and wheel. The diameter of wheel is 40 cm and diameters of axles are 10 cm and 8 cm. Find efficiency and effort lost in friction of the machine.

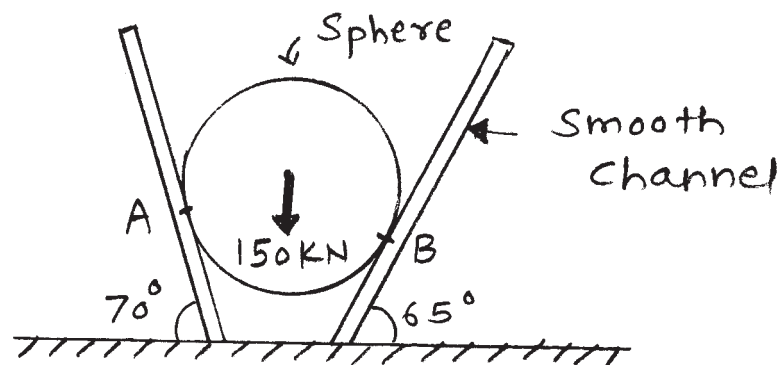
4. Attempt any THREE of the following:

12

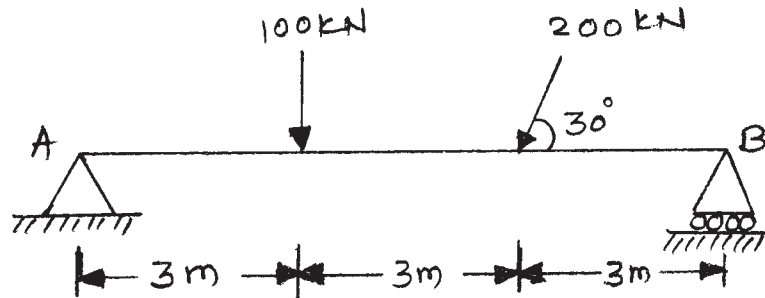
- a) Calculate the moment about point B for the force system as shown in Fig. No. 2.

Fig. No. 2

- b) A sphere weighing 150 kN is resting in a smooth channel. The sides of a channel are inclined at  $70^\circ$  and  $65^\circ$  to the horizontal. Calculate the reactions offered by the channel surface at contact points. Refer Fig No. 3.

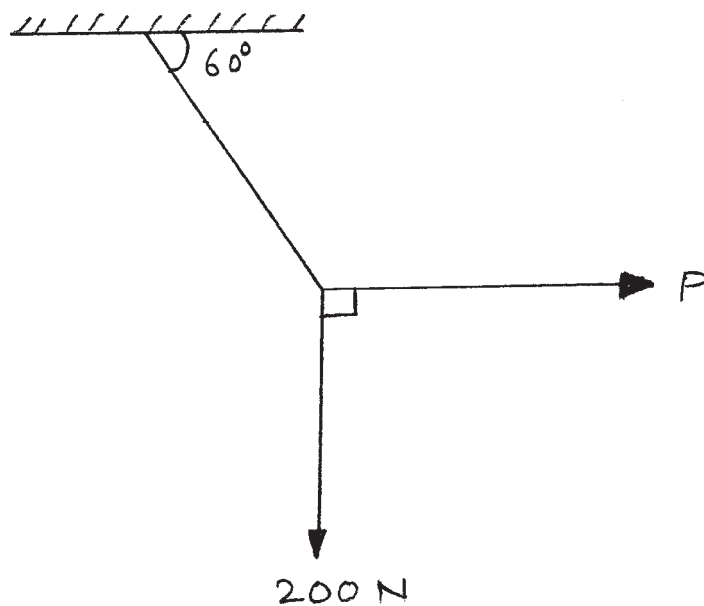
Fig. No. 3

- c) Calculate the reactions of beam at the support as shown in **Fig. No. 4** using graphical method.



**Fig. No. 4**

- d) A block of 4000N is kept on horizontal surface. A horizontal force of 800N is required to just move it. Find.
- Normal reaction
  - Frictional resistance
  - Resultant reaction
  - Coefficient of friction
- e) A horizontal force  $P$  as shown in **Fig. No. 5** keep the weight of 200N in equilibrium. Calculate the magnitude of force  $P$  and tension in the string.



**Fig. No. 5**

5. Attempt any TWO of the following:

12

- a) Determine the support reactions developed for the overhang simply supported beam loaded as shown in Fig. No. 6.

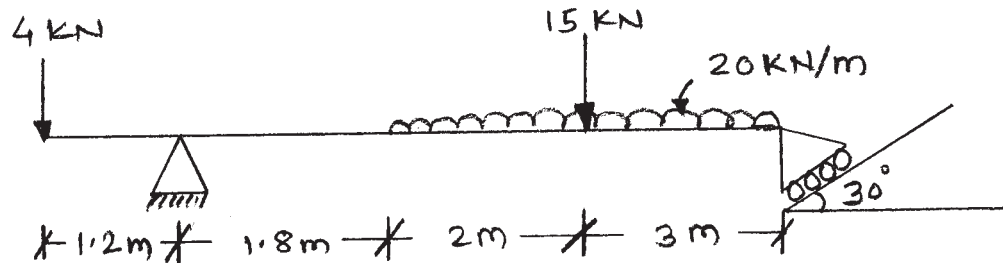


Fig. No. 6

- b) A body resting on a rough horizontal plane is on the point of moving by a pull of 22N acting 30° inclined to horizontal. It is pushed by a force of 28N acting 30° inclined to horizontal. Find the weight of the body and coefficient of friction.
- c) Calculate the resultant in magnitude direction and position with respect to point A for the force system shown in Fig. No. 7.

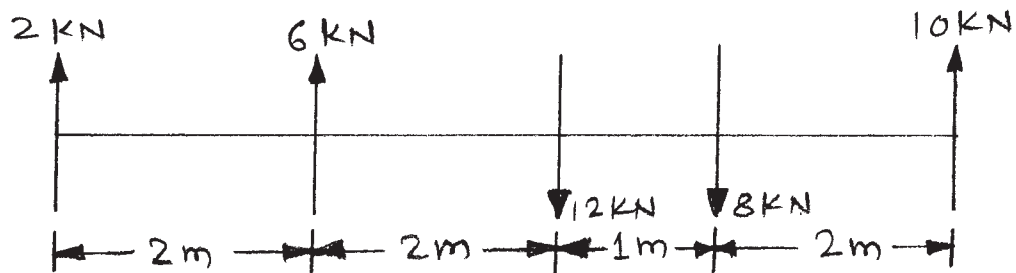


Fig. No. 7

6. Attempt any TWO of the following:

12

a) Find the centroid for a channel section as shown in Fig. No. 8.

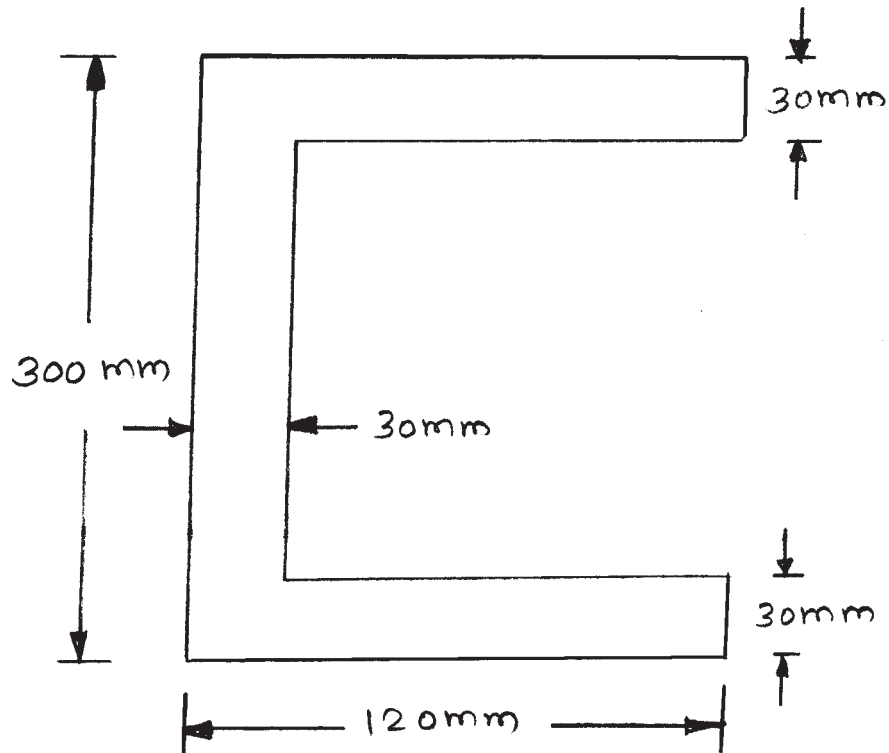


Fig. No. 8

b) Locate the centroid of the lamina shown in Fig. No. 9.

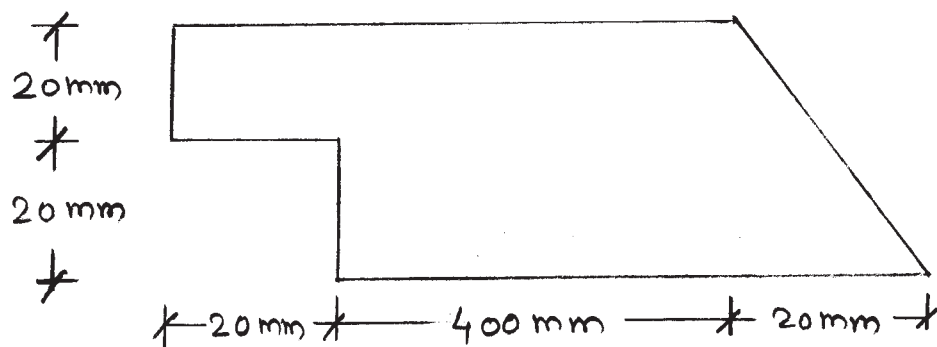


Fig. No. 9

- c) Calculate the centre of gravity of composite solid with respect to  $x$  and  $y$  - axis as shown in **Fig. No. 10**.

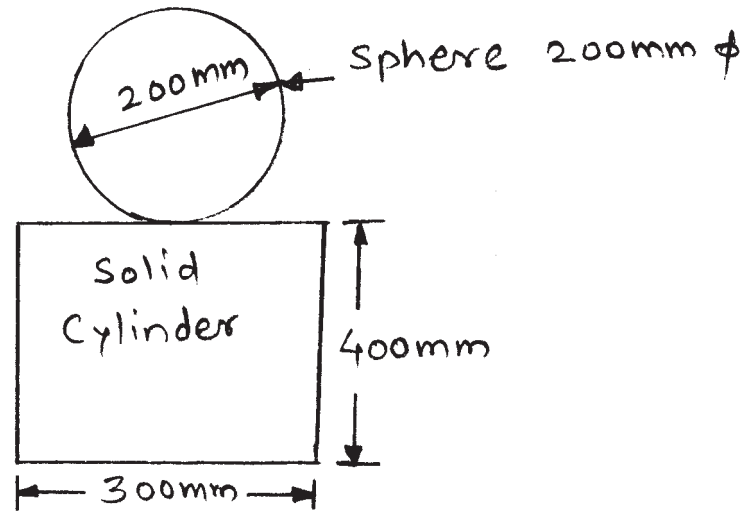


Fig. No. 10

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