

17204

15162

3 Hours / 100 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 TEN of the following :** **20**
- (a) Define effort and effort lost in friction.
  - (b) State any two uses of machines.
  - (c) Draw nature of graph for load against Ideal effort.
  - (d) Define rigid body with one example.
  - (e) State any two effects of force on a body.
  - (f) Define coplanar parallel force system along with neat sketch.
  - (g) What is polar diagram ?
  - (h) State any two types of loading on a beam with sketches.

**P.T.O.**

- (i) State analytical conditions for equilibrium for coplanar concurrent force system.
- (j) State types of friction.
- (k) Define cone of friction.
- (l) State velocity ratio for screw jack with meaning of term involved.

2. Answer any FOUR of the following :

16

- (a) In a certain machine effort was found to move a distance of 30 m, when the load moved through a distance of 1.5 m. If the machine is ideal, find V.R. & M.A. of the machine.
- (b) For a general pulley block number of cogs on effort wheel is 24, that of on load wheel is 6. No. of teeth on the pinion is 4 and that of on spur is 36. If the maximum effort, which can be applied is 60 N, calculate the maximum load that can be lifted, if efficiency of machine is 80%.
- (c) In a double purchase crab, the two pinions have 10 teeth each and the two spur wheel has 60 teeth each. The diameter of load drum is 20 cm and that of effort wheel is 60 cm. Find the velocity ratio.
- (d) Resolve a force of 10 N magnitude passing through co-ordinates (0, 0) and (0, -2).
- (e) Determine the resultant of the forces acting on a hook as shown in fig no. 1.

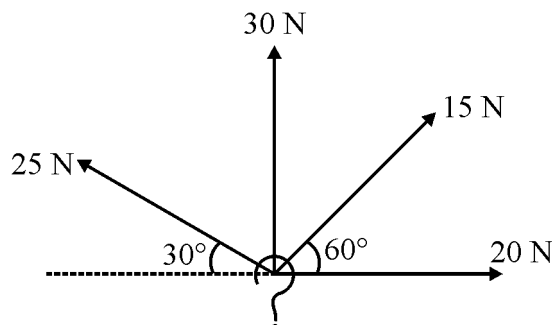


Fig. - 1

- (f) A crank ABC with system of forces acting on it is shown in figure no. 2. Find force 'P' to maintain equilibrium.

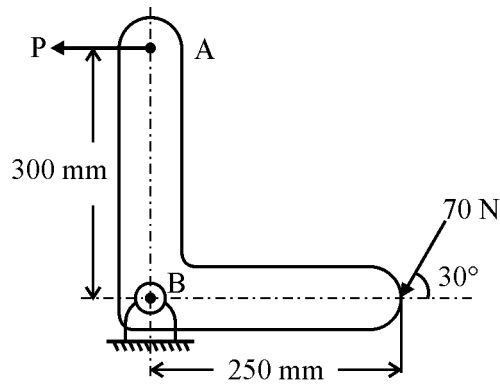


Fig. – 2

3. Attempt any FOUR of the following :

16

- (a) Find the angle between two forces of magnitude 120 N each, such that their resultant is 60 N.
- (b) A square ABCD of 1 m side is subjected to a force of 15 N, 25 N, 35 N, 45 N and 50 N along AB, AD, CB, CD & BD. Find magnitude and direction w.r.t. 'A', shown in figure No. 3.

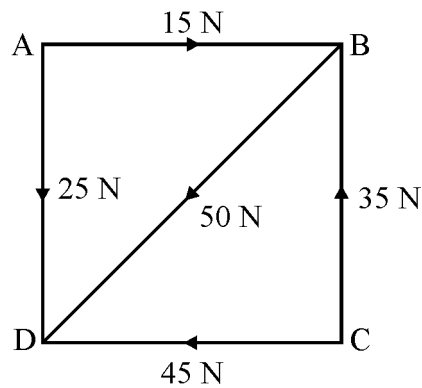
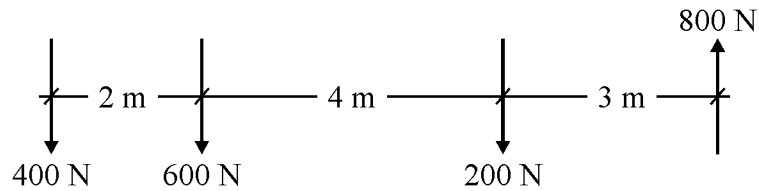


Fig. – 3

- (c) Find the resultant in magnitude and direction if following forces acting away from a point.
- 300 N force acting  $30^\circ$  East of North
  - 150 N force acting  $45^\circ$  West of North
  - 200 N force towards West
  - 400 N force acting  $30^\circ$  West of South.

- (d) Calculate resultant, direction and its position w.r.t. 400 N force for given force system as shown in figure 4.



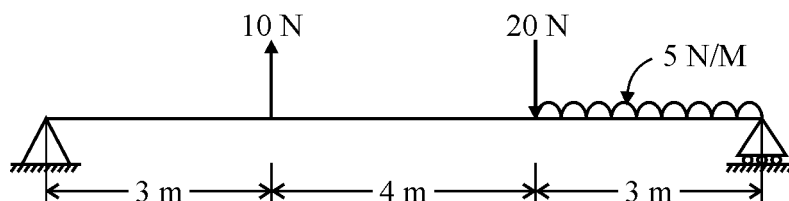
**Fig. – 4**

- (e) Explain the following :
- Resolution of a force
  - Composition of a force
- (f) Solve Que. 3(d) by graphical method.

**4. Attempt any FOUR of the following :**

**16**

- Two men carry a weight 200 N by means of ropes fixed to the weight. One rope is inclined at  $45^\circ$  and other  $30^\circ$  with the vertical. Find tension in each side of rope.
- If four forces acting at a point (all away from the point) are 100 N, 200 N, T and P at  $0^\circ$ ,  $120^\circ$ ,  $240^\circ$  and  $330^\circ$ . Determine the value of 'T' and 'P', if the system is in equilibrium.
- State Lami's theorem and give its limitations.
- A beam of span 4 m is simply supported at its end. It carries a concentrated loads of 40 kN and 20 kN at 1 m and 2 m from the left hand support respectively. It carries udl of 10 kN/m for 2 m from the right end. Determine the reactions at supports.
- Solve Que. 4(d) by graphical method.
- Find the support reactions of simply supported beam shown in figure No. 5.



**Fig. – 5**

## 5. Attempt any FOUR of the following :

16

- (a) A block of 1000 N is kept on a horizontal surface. A horizontal force of 300 N is required to just move it. Find :
- Normal reaction
  - Frictional resistance
  - Resultant reaction
  - Coefficient of friction
- (b) Find the value of  $\mu$  if the body is in limiting equilibrium refer figure No. 6.

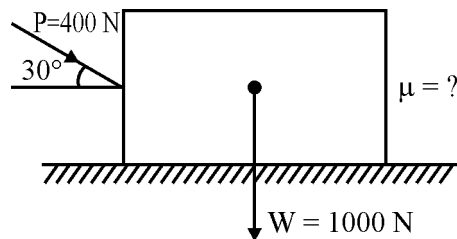


Fig. – 6

- (c) A block weighing 300 N is resting on an inclined plane making an angle  $30^\circ$  with the horizontal. Calculate the pull applied parallel to the plane to move the block up the plane if  $\mu = 0.35$ .
- (d) Draw FBD of a ladder resting against a wall and floor having weight  $W$ .
- (e) Following observations were made in a enp of simple lifting machine with the V.R. = 100

Load	Effort
5 kN	150 kN
10 kN	200 kN

Determine law of machine & max. efficiency of machine.

- (f) In differential wheel and axle, the diameter of wheel is 36 cm and that of axles are 9 cm and 6 cm. If the efficiency of the machine is 80%, find the load lifted with an effort of 100 N.

6. Attempt any FOUR of the following :

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- (a) Locate the centroid of 'T' section  $100 \times 100 \times 10$  mm having total depth of 100 mm.
- (b) Locate the centroid of the shaded area as shown in figure no. 7

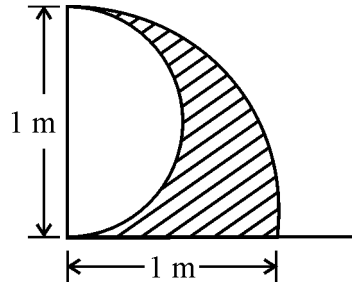


Fig. - 7

- (c) Define centroid. Show on sketch the C.G. of a semicircle of diameter 200 mm.
- (d) Locate the position of centroid of an ice-cream cone as shown in figure no. 8.

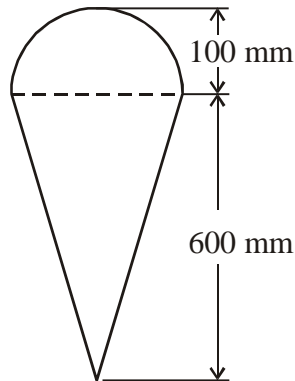


Fig. - 8

- (e) Find the  $\bar{y}$  of the composite body given in figure no. 9.

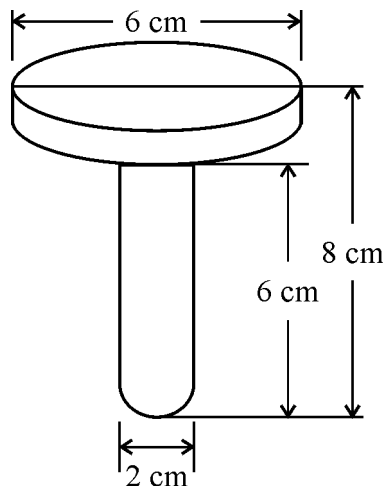


Fig. - 9

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- (f) The frustum of a cone has top diameter 40 cm and bottom diameter 60 cm with height 18 cm. Calculate  $\bar{Y}$  only.

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