

17350

21314

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 Packet Calculator is permissible.
 - (7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Exhumation Hall.

Marks

1. Attempt any TEN of the following :

20

- a) Define one Newton force.
- b) Define moment of force and state its S.I. units.
- c) Differentiate between resultant and equilibrant.
- d) State the conditions of equilibrium.
- e) Define frictional force. Write one situations where it is advantageous.
- f) Define angle of friction and angle of repose.

P.T.O.

- g) State the position of centre of gravity of centroid in following cases.
- Solid hemi-sphere
 - Solid cone
 - Semi-circle
 - Triangle
- h) Calculate the centroid of semi-circle of radius 100 mm.
- i) Define self locking machine.
- j) Write the velocity ratio of double purchase crab with all notations.
- k) Define bulk modulus.
- l) Write the expression for strain energy due to any type of load.

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

16

- a) Calculate resultant in magnitude, direction and position with respect to 40 kN force for the parallel force system. Shown in Fig. No. 1.

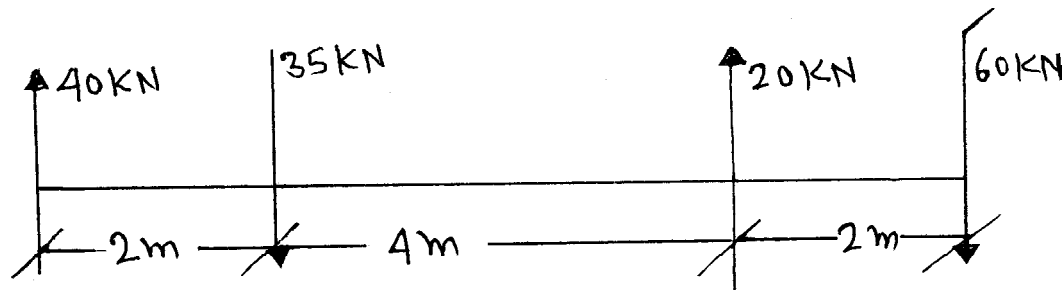


Fig. No. 1

- b) Resolve a force of 100 N into two directions 40° and 50° on either side of it acting on positive side of X-axis.
- c) Four forces 25N, 20N, 40N and 35N are acting at 0° , 60° , 90° , 150° from X-axis taken in order. Find resultant by graphical method.

- d) A simply supported beam ABC of span 2m and an overhang of 1m is loaded as shown in Fig. No. 2. Find the reaction at A and B analytically.

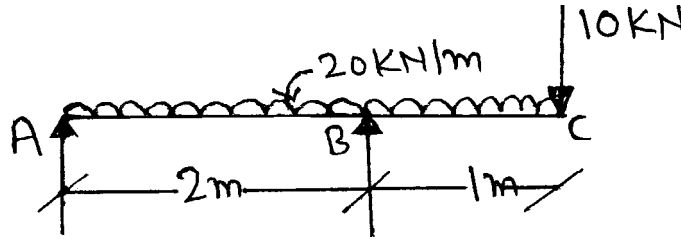


Fig. No. 2

- e) Draw a free body diagram for a body moving down the inclined plane when force is applied parallel to the horizontal plane and away from the body.
- f) Write any four properties of couple.

3. Attempt any FOUR of the following :

16

- a) In a Jib crane the Jib is making an angle of 25° to vertical and the tie is making an angle of 70° to the vertical. If the crane lifts a load of 10 kN. Calculate the internal forces in Jib and Tie ?
- b) A string ABCD is fixed at A and D. Two weights 400 N and "W" N are attached at B and C the string AB, BC and CD are making angles of 60° , 10° and 45° with horizontal respectively. Find the "W" and tensions in the string.

- c) Locate the centroid of L-section in Fig. No. 3 having the flange 10×80 mm and web 10×120 mm.

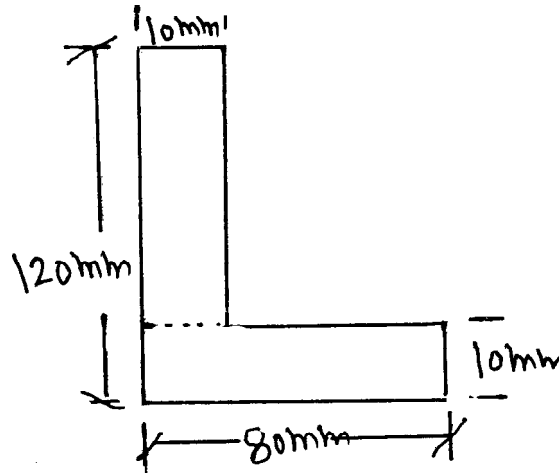


Fig. No. 3

- d) A body resting on a rough horizontal plane is on the point of moving by a pull of 22 N acting 30° inclined to horizontal. If it is pushed by a force of 28 N acting 30° inclined to horizontal. Find the weight of body and coefficient of friction.
- e) Find the value of “P” required to make the weight (Block) to start moving up (Refer Fig No. 4.)

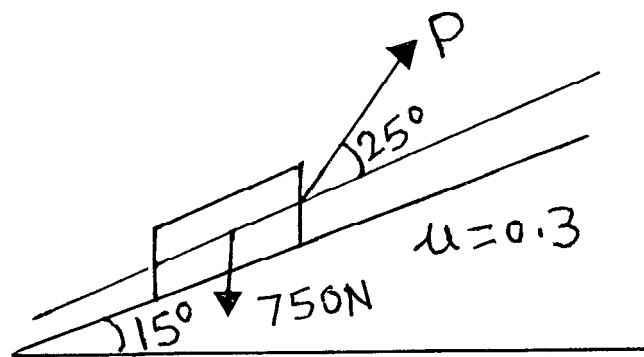


Fig. No. 4

- f) Two unlike parallel forces of 10 kN magnitude act a distance of 2m. apart. Name the force system and give the magnitude of resultant.

4. Attempt any TWO of the following :

16

- a) Determine the support reactions developed for the overhanging simply supported beam loaded as shown in Fig. No. 5.

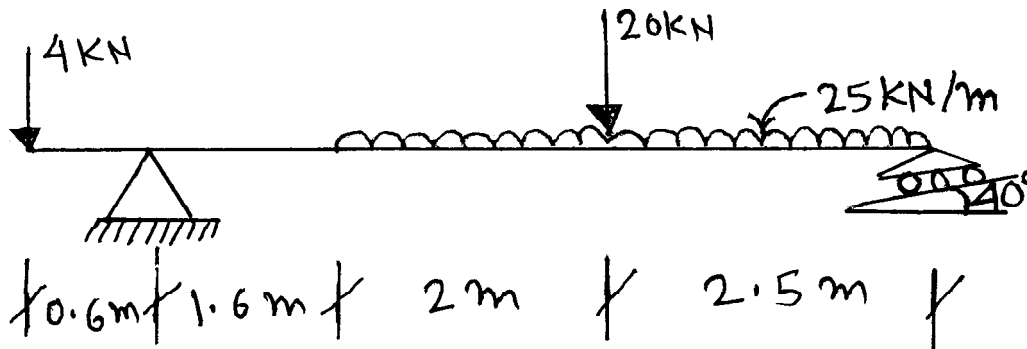


Fig. No. 5

- b) A man weighing 75 N stands on the middle run of the ladder weighing 25 N. It is resting on a smooth floor and against a wall. The ladder is prevented from slipping by a string OD. Find the tension in the string and reactions at A and B as shown in Fig. No. 6.

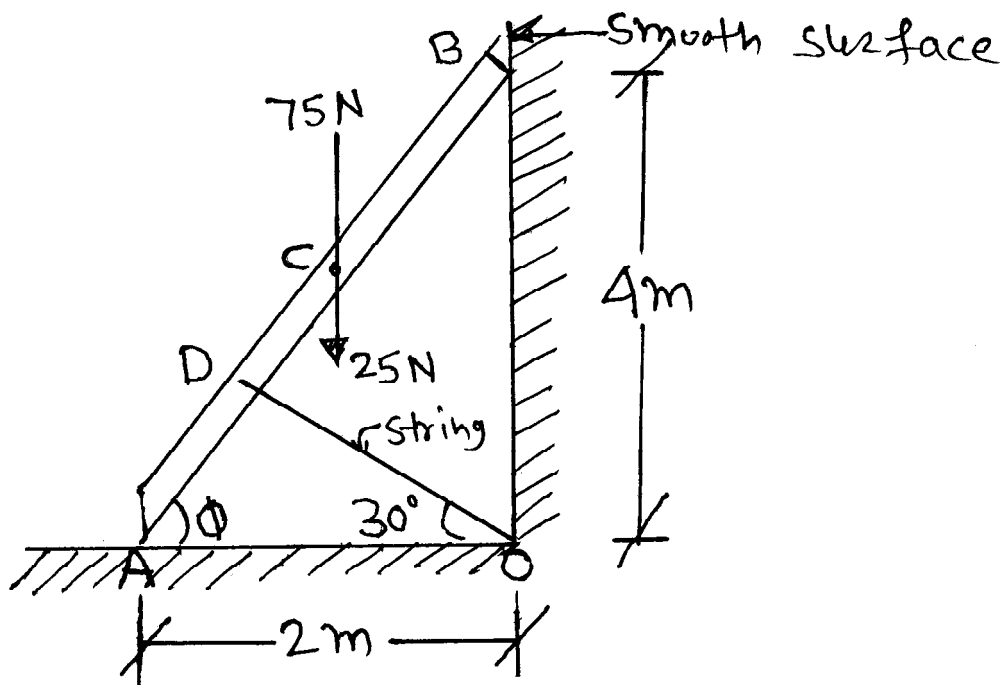


Fig. No. 6

- c) A hemisphere of 60 mm diameter is placed on the top of cylinder of diameter 60 cm and height of 100 cm. Find the common centre of gravity of the two from the base of the cylinder.

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

16

- a) Find the centre of gravity of the dum wall having top 1m, bottom 3m, height 4m and face of the wall on VP stream side is vertical.
- b) Find the centroid of the lamina as shown in Fig. No. 7.

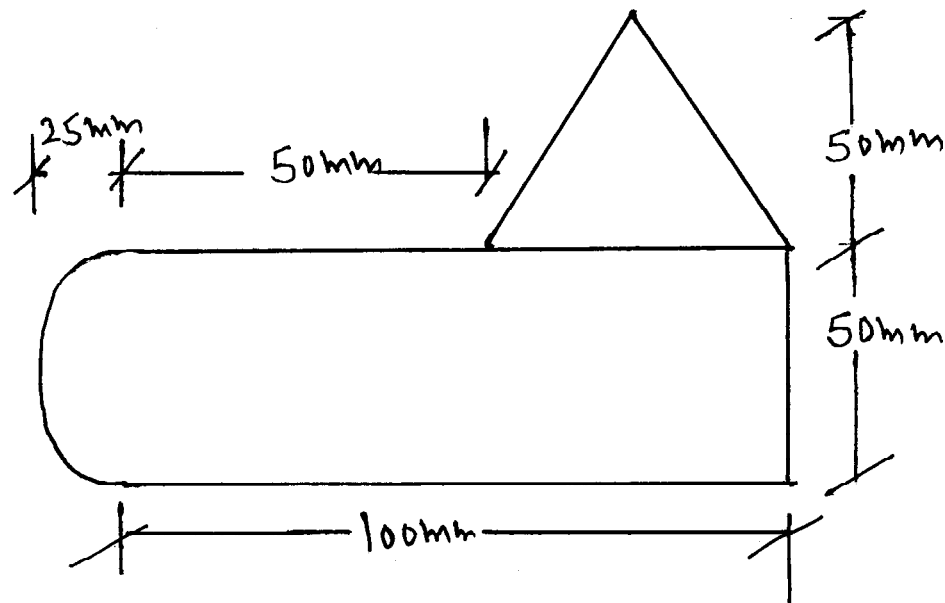


Fig. No. 7

- c) The velocity ratio of a certain machine is 50. Determine the effort required to lift a load at 1500 N if efficiency of machine is 40%.

- d) A screw Jack has effort wheel diameter of 200 mm. and pitch is 5 mm. Find V.R. if a load of 1000 N is lifted by an effort of 250 N Find the efficiency of machine.
- e) A wire 4mm in diameter, 4m long and subjected to an axial pull of 1890 N is stretched by 3mm under the axial pull. Find stress, strain induced. Also find modulus of elasticity.
- f) State Hooke's law. Draw stress-strain curve for mild steel showing important points.

6. Attempt any **TWO** of the following :

16

- a) Following table shows the observations taken on certain machine. Draw a graph of load against effort and write the law of machine and find M.A. and find maximum efficiency of machine if V.R. = 40

Load	Effort
100 N	10 N
200 N	14 N
300 N	18 N
400 N	22 N

- b) A Weston's differential pulley block is used to lift a load of 8 kN. The diameters of pulleys are 26 cm and 24 cm. Calculate the effort required if the efficiency is 45%. Also calculate the load lost in friction.
- c) A cube of 200 mm side is subjected to a compressive force of 36 MN on each face. The change in volume is found to be 5125 mm². Find E and K. if $\frac{1}{m} = 0.25$.

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