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3 Hours / 70 Marks Seat No. 1 8 0 1 0 4

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 reversible machine. What is its condition ?

(b) Explain principle of transmissibility of forces.

(c) State the analytical condition of equilibrium of coplanar non-concurrent force system.

(d) Write any two laws of kinetic friction.

(e) Define centroid and centre of gravity.

(f) Write the formula for V.R. of double purchase crab winch machine with meaning of each symbol.

(g) State the parallelogram law of forces.

2. Attempt any THREE of the following : **12**

(a) In a simple screw jack, the pitch of the screw is 10 mm and length of the handle is 450 mm find V.R. if an effort of 25 N is applied at the end of handle can lift the load of 3 kN. Find the efficiency of the screw jack. Also calculate amount of effort lost in friction.

(b) A Weston's differential pulley block is used to lift a load of 8 kN. The diameter of pulleys are 26 cm and 24 cm. Calculate the effort required if the efficiency is 45%. Also calculate load lost in friction.

(c) The law of certain machine is $\rho = \frac{W}{50} + 8$ N and V.R. = 100, find the maximum possible M.A. and maximum possible efficiency. While lifting a load of 600 N what will be its efficiency ?

(d) (i) Draw the nature of graph of efficiency against load for the machine.

(ii) Give any two point of difference between ideal machine and actual machine.

3. Attempt any THREE of the following : **12**

(a) Calculate the tension induced in the cable used for the assembly as shown in fig. 1. Take weight W = 1500 N.

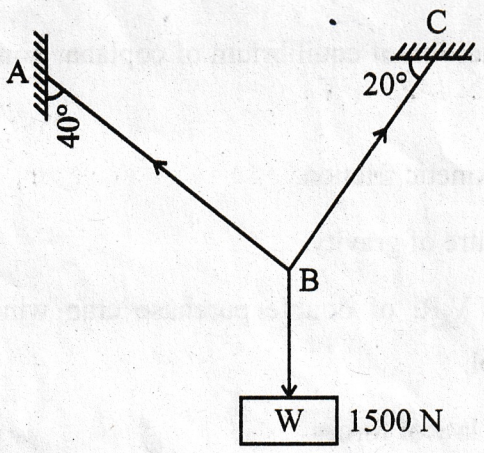

Fig. No. 1

(b) From following fig. 2, find the support reactions for given simply supported beam.

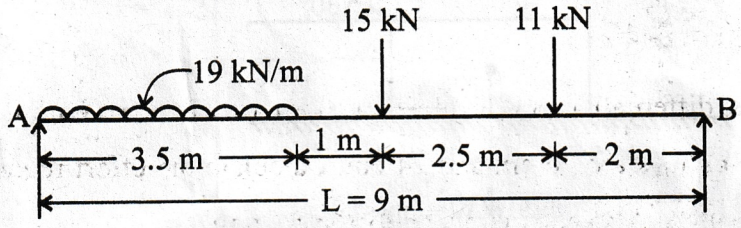

Fig. No. 2

(c) Using analytical method, calculate the support reactions for the beam loaded as shown in fig. 3.

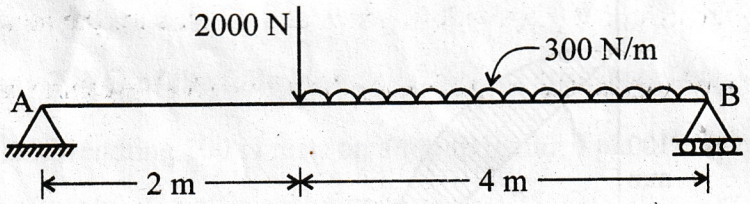

Fig. No. 3

(d) Explain Lami's theorem. Write its any three limitations.

4. Attempt any THREE of the following : **12**

(a) Determine the resultant of the coplanar non-concurrent forces as shown in fig. 4.

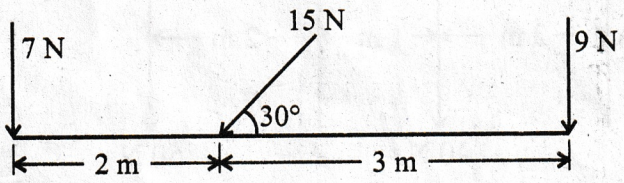

Fig. No. 4

(b) Find the value of W if the body is in limiting equilibrium.

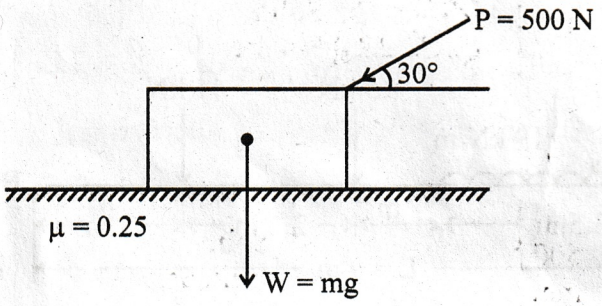

Fig. No. 5

(c) Locate the centroid of the shaded area as shown in fig. 6.

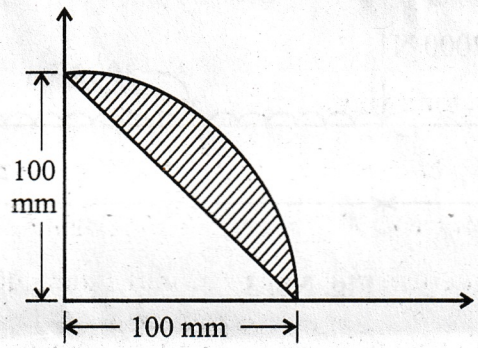

Fig. No. 6

(d) Locate graphically the position of resultant force for parallel force system as shown in fig. 7 with respect to point A.

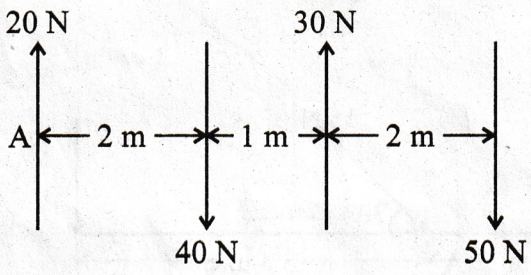

Fig. No. 7

(e) Find the centre of gravity of a composite solid with respect to Y-axis.

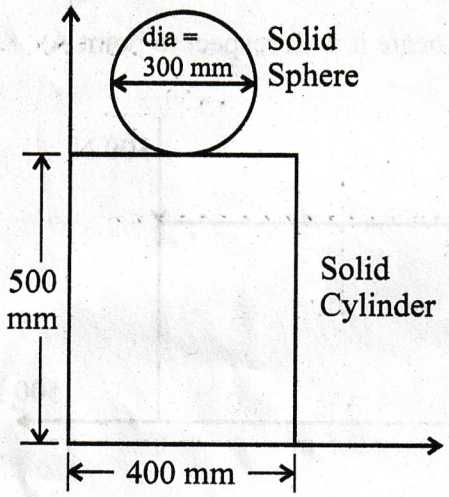

Fig. No. 8

5. Attempt any TWO of the following : **12**

(a) A block weighing 100 N rests on a rough inclined plane having 30° angle with the horizontal. Co-efficient of friction is 0.25. Calculate force required to be applied parallel to the slope of the plane to start sliding upward.

(b) Find the resultant of concurrent force system as shown in fig. 9 in magnitude and direction by analytical method.

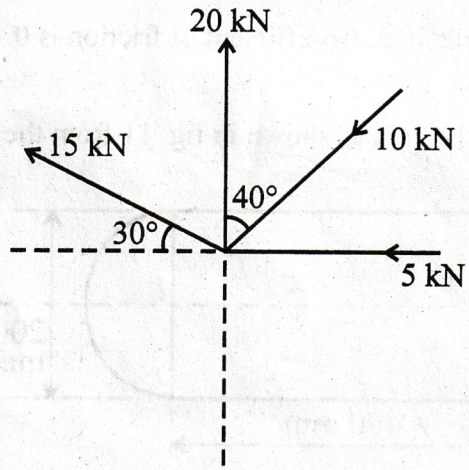

Fig. No. 9

(c) Calculate the magnitude and direction of the resultant force for a force system as shown in fig. 10. Locate it with respect to point A.

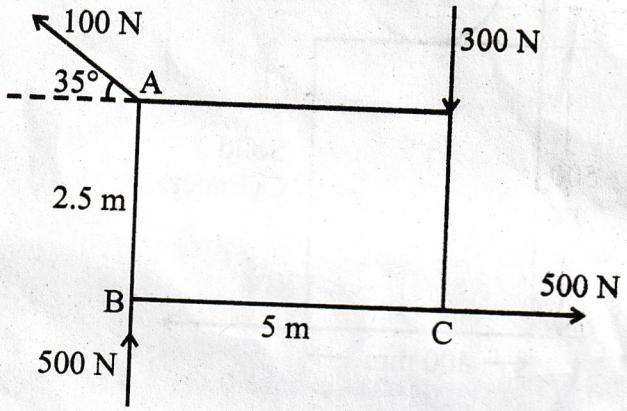

Fig. No. 10

6. Attempt any TWO of the following : **12**

(a) Calculate the force ρ applied parallel to the plane just to move the block up the plane, if the block weighting 500 N is placed on an inclined plane at an angle of 20° with horizontal. Co-efficient of friction is 0.14.

(b) Find the centroid of the area as shown in fig. 11 from the bottom.

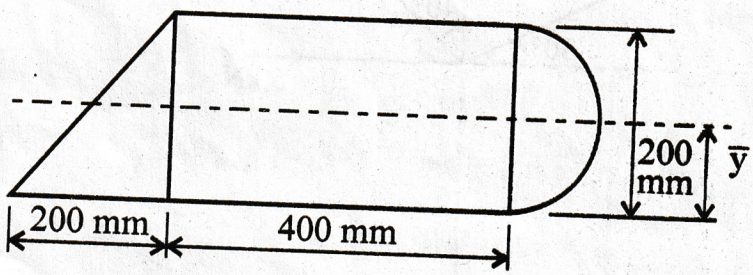

Fig. No. 11

(c) A L-section having flange 20 × 100 mm and web 20 × 100 mm. Overall depth is 120 mm. Locate the position of centroid from X-axis and Y-axis.
