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3 Hours / 70 Marks Seat No. | | | | | | | | |

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 mechanical advantage and velocity ratio.

b) State Varignon's theorem of moment.

c) State Lami's theorem.

d) Define coefficient of friction.

e) Define centroid and centre of gravity.

f) Define force and state it's SI unit.

g) State VR of worm and worm wheel.

P.T.O.

Marks

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

a) Explain law of machine. State it's use.

b) In a differential axle and wheel, the diameter of the wheel is 40 cm and that of axles are 10 cm and 8 cm. If an effort of 50 N can lift a load of 1500 N, Find efficiency of the machine.

c) A machine has a VR of 250 and has it's law P = (0.01 w + 5)N, Find mA, efficiency effort lost in friction at a load of 1000 N and also state whether machine is reversible or not.

d) The diameter of bigger and smaller pulley's of Weston's differential pulley block are 250 mm and 100 mm respectively. Determine effort required to lift a load of 2 KN with 80% efficiency.

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

a) Find the reaction offered by planes. Refer Fig. No. 1. A sphere weighs 600 N is supported by two planes. One plane is vertical and other is inclined at 60° to the horizontal.

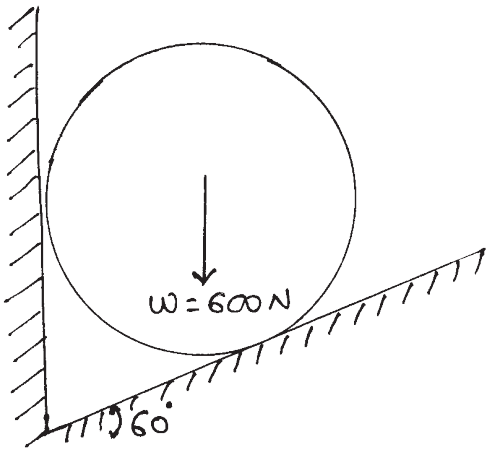

Fig. No. 1

Marks

b) Calculate tension in the string AB and BC if a weight of 500 N is attached by two strings as shown in Fig. No. 2.

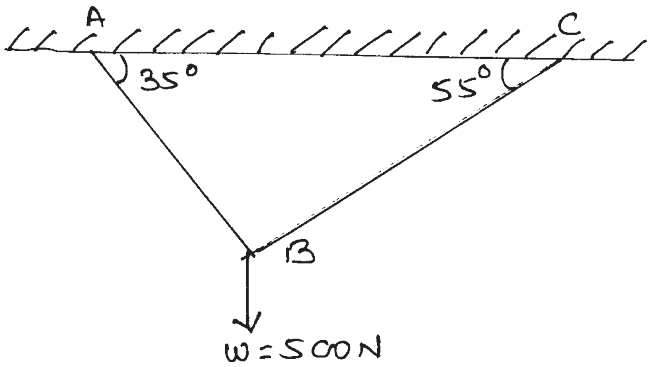

Fig. No. 2

c) Calculate the reaction using analytical method for a beam shown in Fig. No. 3.

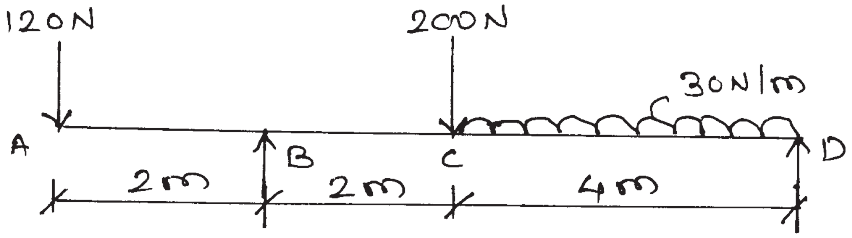

Fig. No. 3

d) Differentiate equilibrant from resultant.

4. Attempt any THREE of the following : 12

a) Calculate the magnitude and direction of resultant for concurrent force system as shown in Fig. No. 4.

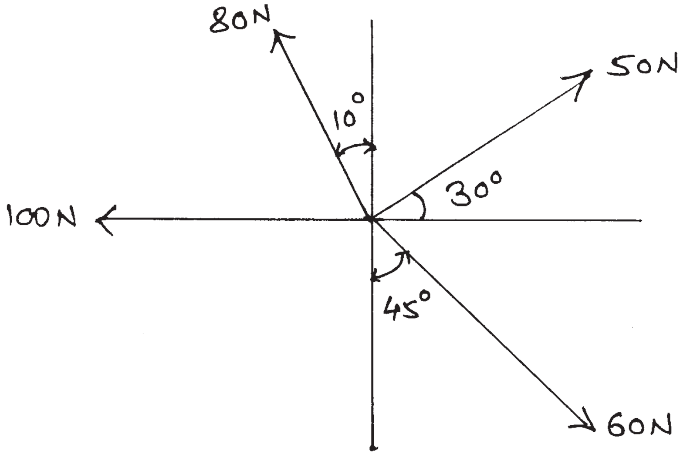

Fig. No. 4

Marks

b) A block weighing 600 N resting on a rough horizontal plane can be moved by a force of 150 N applied at an angle of 30° with horizontal. Find coefficient of friction.

c) Locate the centroid of T-section 100 × 100 × 10 mm having total depth of 100 mm.

d) Two forces 6 N (Horizontal) and 8 N (Inclined) act on a particle and their lines of actions are inclined to each other at an angle of 70°. Find the resultant.

e) Locate the position of centroid of an ice-cream cone as shown in Fig. No. 5.

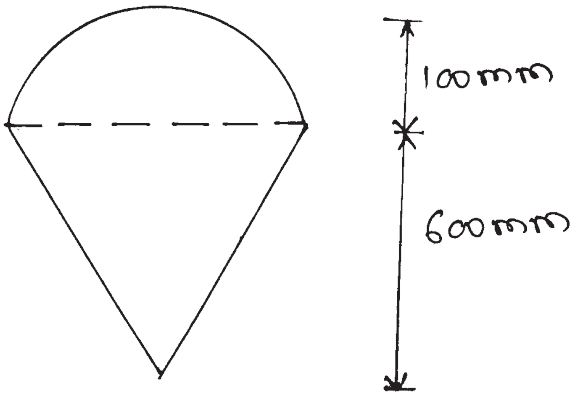

Fig. No. 5

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

a) Find the resultant in magnitude and locate it on the sketch with respect to point 'A' for the force system shown in Fig. No. 6.

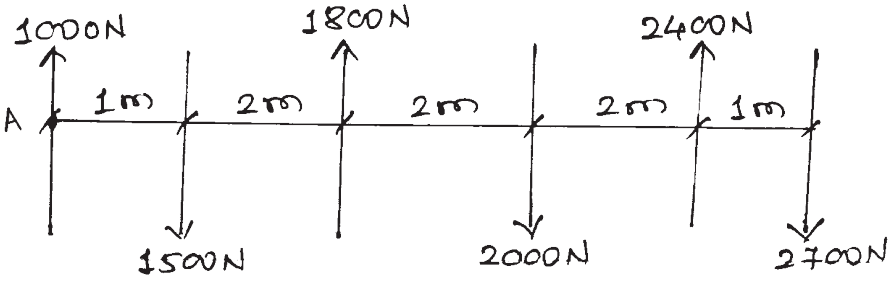

Fig. No. 6

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b) A system of coplaner, non-concurrent forces is shown in Fig. No. 7. Determine the resultant in magnitude and direction w.r.t. A point. Draw the figure showing correct position of the resultant.

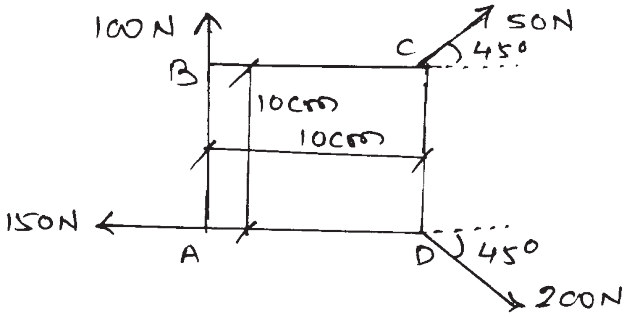

Fig. No. 7

c) A body of weight 400 N is resting on a rough inclined plane at an angle of 15°. If coefficient of friction is 0.14. What force is required to prevent the body from falling down the plane.

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

a) 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. It is pushed by a force of 28 N acting 30° inclined to horizontal. Calculate the weight of body and coefficient of friction.

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

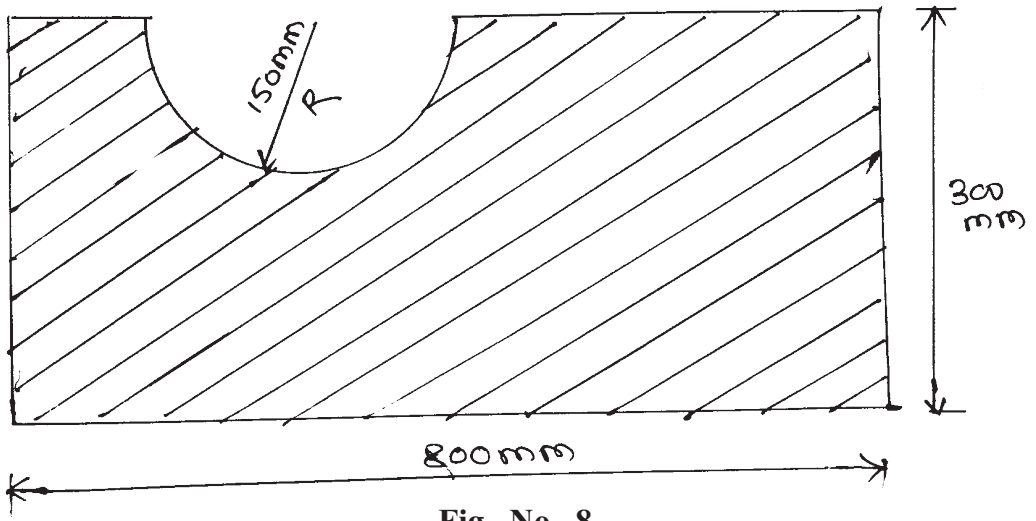

Fig. No. 8

P.T.O.

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c) Locate the centre of gravity for the solid as shown in Fig. No. 9.

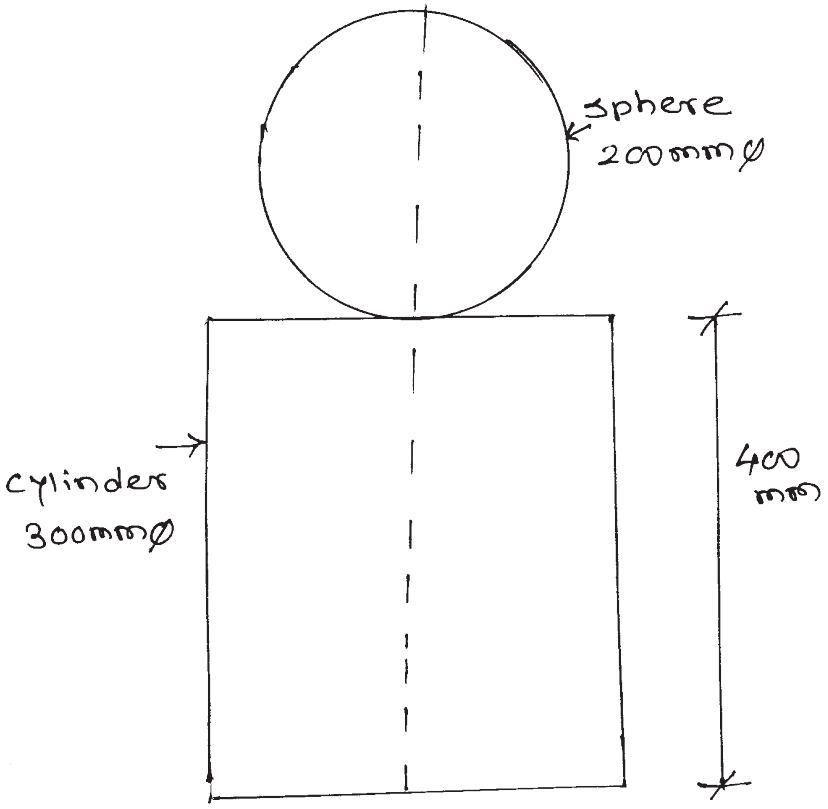

Fig. No. 9