22203

12526

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

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) 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) State four effects of forces on rigid body.

b) Define velocity ratio and mechanical advantage of a simple machine.

c) Write any four properties of couple.

d) State any two types of beams with diagram.

e) State any four laws of friction.

f) Calculate and show in sketch the centroid of semi circle of dia. 100 mm.

g) State graphical condition of equilibrium for non-concurrent forces.

P.T.O.

Marks

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

a) Write different types of coplanar forces.

b) In a lifting machine a load of 20 kN is raised by effort of 600 N. If the efficiency is 75% Calculate M.A. and V.R. Find the law of machine.

c) Define effort lost in friction and load lost in friction giving expressions of them.

d) Write two advantages and two disadvantages of friction.

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

a) Five forces of 100 N, 200 N, 300 N, 400 N and 500 N are acting at an angle of 50°, 110°, 220°, 290° and 340° in anticlockwise direction from the X-axis at a point, all are acting away from the point. Find the resultant force in magnitude and direction.

b) Explain space diagram and vector diagram for a concurrent force system.

c) The diameters of bigger and smaller pulley's of Weston's differential pulley block are 300 mm and 200 mm respectively. Determine the effort required to lift a load of 5 kN with 70% efficiency.

d) A machine has V.R. = 40, A load of 6 kN is lifted by an effort of 240 N. Calculate M.A., efficiency, effort lost in friction and ideal effort.

Marks

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

a) Determine the resultant of coplanar non-concurrent force as shown in Fig. No. 1.

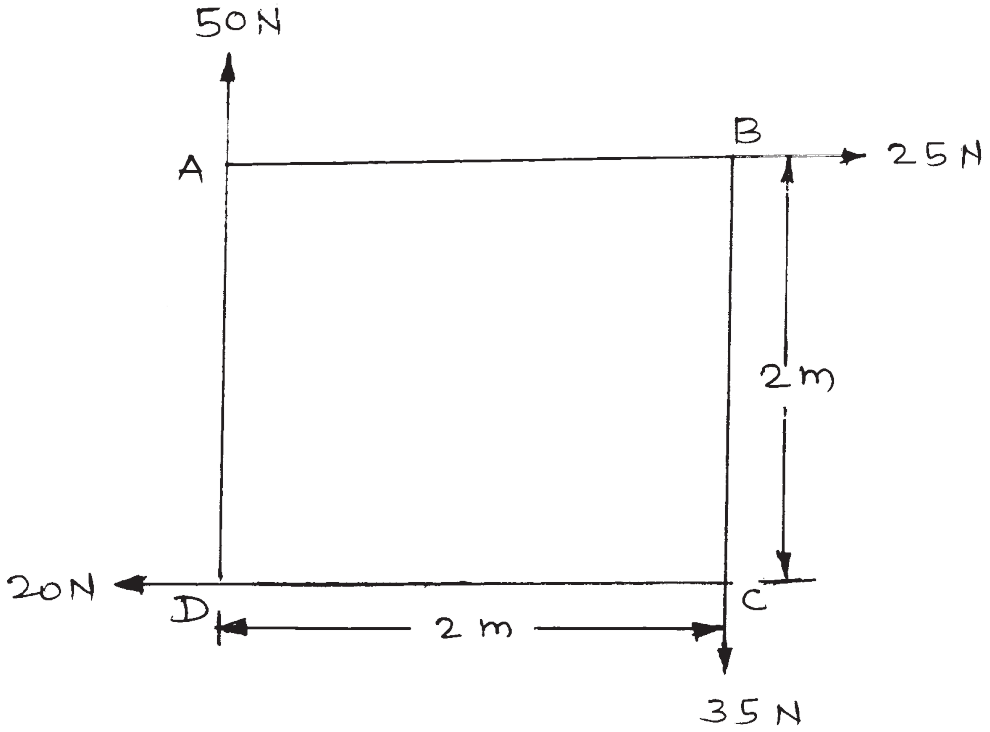

Fig. No. 1

b) A sphere of weight 800 N rests in a groove of smooth inclined surfaces which are making an angle of 40° and 70° inclination to the horizontal. Find the reactions at the contact surfaces.

c) A beam of 6 m span simply supported at ends. It carries three point loads of 12 kN, 18 kN, 24 kN at 1 m, 3 m and 4 m respectively from left hand support. Calculate reactions at the end of the beam graphically.

d) A block weighing 300 N is resting on an inclined plane making an angle 30° with the horizontal. Calculate the pull applied parallel to the plane to move the block up the plane if $\mu = 0.35$.

e) A body of weight 60 kN is hung by means of a string to the ceiling. Determine the pull required and tension in the string when the string has an inclination 60° with the ceiling and pull is applied at 40° with horizontal.

Marks

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

a) Find out the support reactions of the simply supported beam shown in Fig. No. 2 below by analytical method.

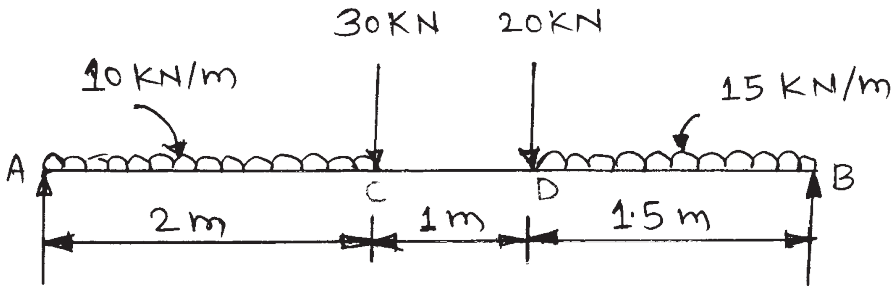

Fig. No. 2

b) A pull of 30 N applied at 30° to horizontal just moves the block of weight 'W' N. If angle of friction ϕ = 16°, Find coefficient of friction, total reaction and weight of block.

c) Five parallel forces of magnitude 3 MN, 6 MN, 15 MN, 10 MN and 12 MN are acting at 2 m, 4 m, 5 m and 7 m from the first force. Among these forces 1st, 2nd and 5th force are acting upwards while other acting downwards. Find their resultant analytically and locate it with respect to 3 MN force.

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

a) Find the centroid of the lamina shown in the given Figure No. 3.

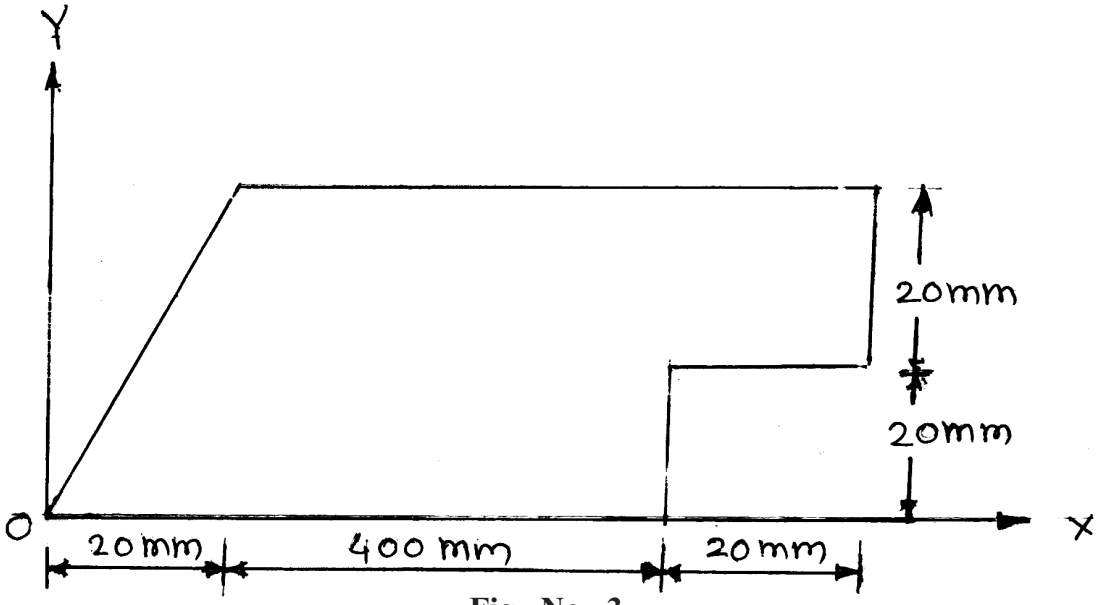

Fig. No. 3

Marks

b) From a cylinder having 200 mm as base and 400 mm as height a cone with same base and height is cut off from bottom. Calculate the C.G. of remaining solid with respect to base.

c) Locate the position of centroid for the lamina shown in Figure No. 4 with respect to extreme left edge.

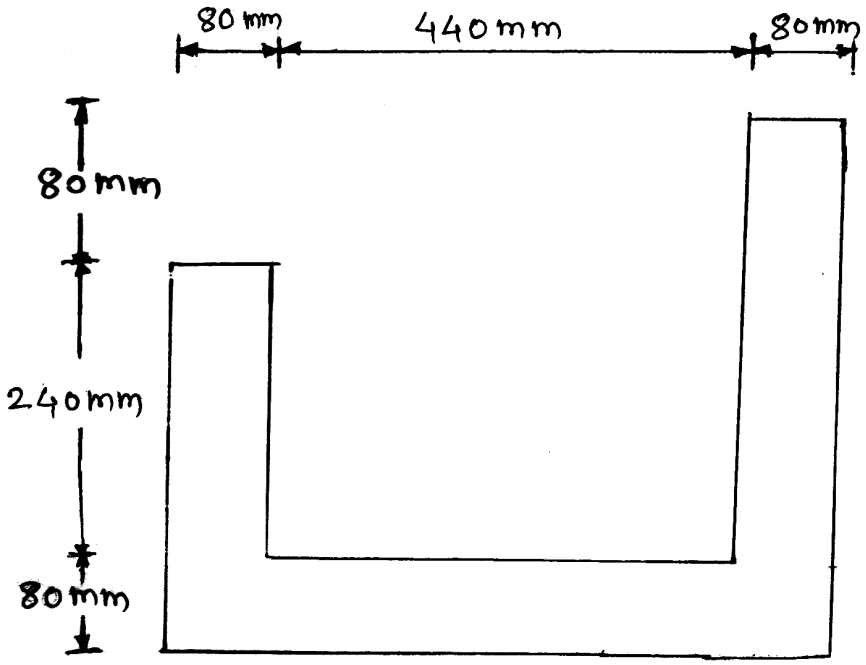

Fig. No. 4