14115

3 Hours/100 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**.

MARKS

1. Attempt **any ten** of the following :   **20**

   a) Give four characteristics of a force.

   b) Define moment and state its S.I. unit.

   c) List two properties of couple.

   d) List two types of beam with sketches.

   e) List two conditions of equilibrium.

   f) List two advantages of friction.

   g) Show in sketch the C.G. of a semi circle of diameter 100 mm.

   h) Locate the centre of gravity of solid cone of a height 600 mm and 100 mm dia.

   i) Define mechanical advantages and velocity ratio.

   j) Define an actual machine and an ideal machine.

   k) Define elasticity and plasticity.

   l) Define Hook's law.

2. Attempt **any four** of the following : **16**

a) List the different types of co-planer forces.

b) Resolve a force at 75 N into two directions 30° and 50° on either side of it.

c) Two forces of 100 KN and 200 KN acting at and away from the point and making an angle at 30° with each other. Find resultant in magnitude and direction.

d) Determine the resultant in magnitude and direction for con-current force system as shown in Fig.No. 1 (d).
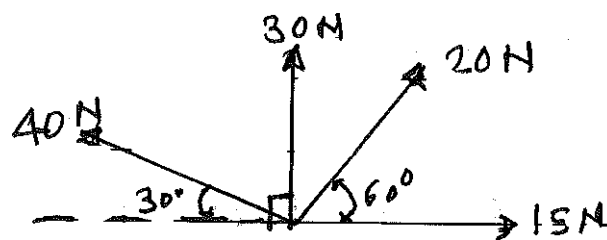

Fig. No. 1 (d)

e) Determine analytically, magnitude, direction and position with respect to 5 KN force of given force system. Fig. No. 2 (e).
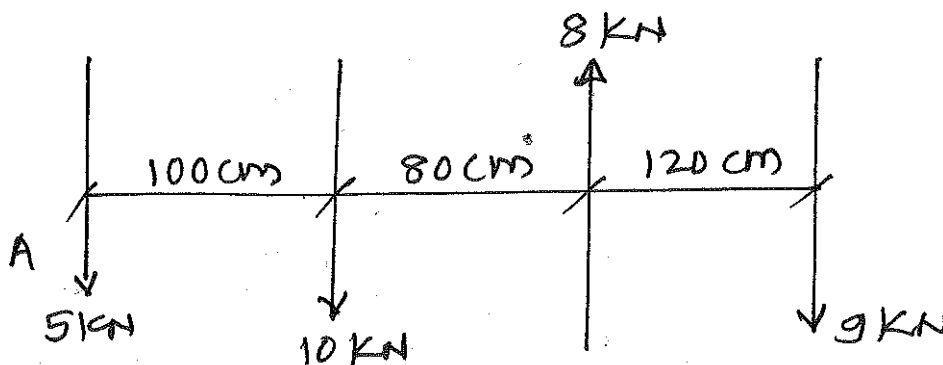

Fig. No. 2 (e)

f) Locate graphically the position of resultant for parallel force system as shown in Fig. No. 2 (e) w.r.t. point A.

3. Attempt **any four** of the following :   **16**

   a) State Lami's theorem with sketch.

   b) A sphere weight 1500 N. It is suspended by two strings at 35° and 60° to the horizontal respectively. Calculate support reactions.

   c) A simply supported beam AB of span 6 m has two point load of 8 KN and 10 KN at 2 m and 3 m from left hand support. Calculate reactions at A and B.

   d) A weight of 100 N is attached by two strings as shown in Fig. No. 3 (d), calculate tension in strings.
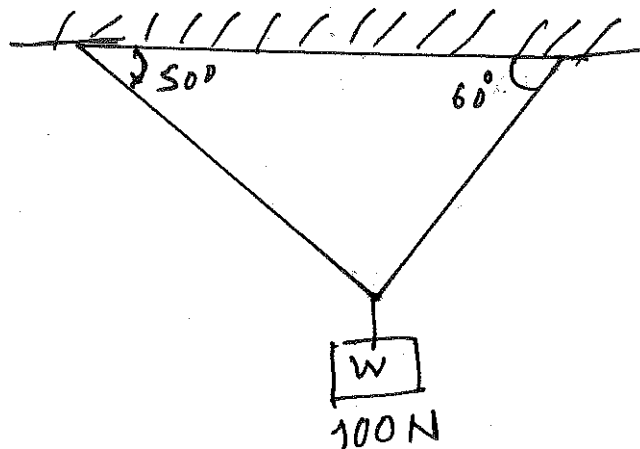

Fig. No. 3 (d)

   e) Define angle of repose and angle of friction.

   f) A body of weight of 400 N resting on a inclined plane at an angle of 30° with horizontal just started to move down the plane. Calculate coefficient of friction.

4. Attempt **any four** of the following : 16

a) A block of 800 N is kept on horizontal surface. A horizontal force of 250 N is required to just move it. Find (a) coefficient of friction (b) normal reaction (c) resultant reactions.

b) A body weighing 300 N is resting on a rough horizontal plane. A pull of 40 N applied at 25° up the horizontal just move the body. Find coefficient of friction.

c) Define moment of inertia and calculate radius of gyration for rectangular section.

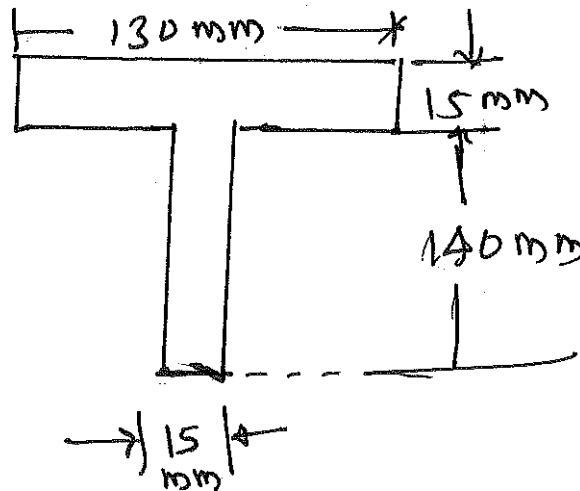d) Calculate centroid for 'T' section as shown in Fig. No. 4 (d).

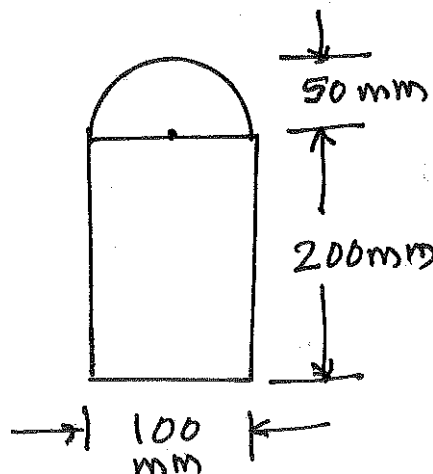Fig. No. 4 (d)

e) Calculate centroid for given Fig. No. 5 (e).

Fig. No. 5 (e)

f) A solid cone of height 50 cm is placed on a cube of 20 cm side as shown in Fig. No. 6 (f). Locate position of C.G. Dia. of cone is 20 cm.
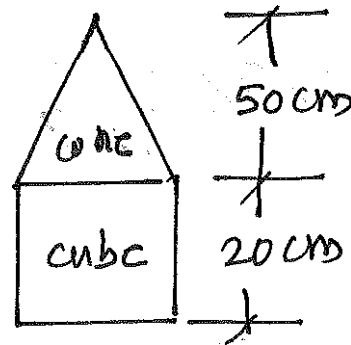

Fig. No. 6 (f)

5. Attempt **any four** of the following : **16**

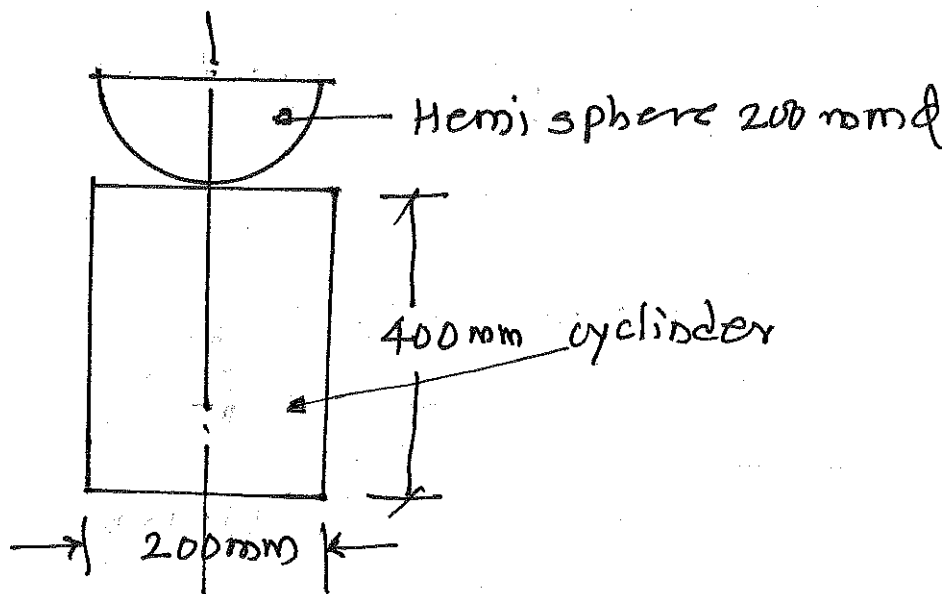a) Find the center of gravity for the solid as shown in Fig. No. 7 (a).

Fig. No. 7 (a)

b) State law of machine with sketch.

c) The velocity ratio of a certain weight lifting machine is 25. Determine the effort required to lift a load of 100 N if the efficiency of machine is 30%.

d) Following observations were made in an experiment as simple machine with VR-50.

Load	6 KN	9 KN
Effort	140 N	200 N

Find law of machine, max. M.A. and max. % η.

e) A simple screw jack has pitch of 2 mm and length of handle is 180 mm. A load of 250 N is lifted by applying effort of 1 N. Find efficiency of machine.

f) The diameter of wheel in differential wheel and axle is 40 cm. The axles are 9 cm and 6 cm. If the efficiency of the machine is 75% find the load lifted by an effort of 100 N.

6. Attempt **any four** of the following :   **16**

a) Draw the diagram for single purchase crab and label any four parts.

b) Define the terms :

   I) Young's modulus

   II) Bulk modulus

   III) Modulus of rigidity

   IV) Possions ratio

c) Draw the stress-strain curve for the ductile material.

d) Define the terms

    I) Stress

    II) Strain

    III) Creep

    IV) Brittleness.

e) List out assupmtions made in theory of pure torsion.

f) If E = 2.5 G ; find the value of Poisson's ratio (μ).

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