

17350

21819

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

Marks

1. **Attempt any TEN of the following:** **20**
- a) Differentiate between statics and dynamics.
 - b) State principle of transmissibility of force.
 - c) State the analytical conditions of equilibrium for concurrent force system.
 - d) Define Lami's theorem.
 - e) List out types of loads.
 - f) Define angle of repose.
 - g) Define centre of gravity.
 - h) Locate C.G of a hemisphere of diameter 150 mm.

P.T.O.

- i) Define self-locking machine and give it's condition.
- j) State the concept of ideal machine.
- k) Define stress and strain.
- l) State Hooke's law of elasticity.
- m) Define mechanical advantage and velocity ratio.
- n) State any four mechanical properties of material.

2. Attempt any FOUR of the following:

16

- a) Resolve a force of 60N acting horizontal in two directions on either side at an angle of 30° each.
- b) Resolve each of the following forces into orthogonal components.
 - (i) 350N acting South-West away.
 - (ii) 40N acting 40° West of South away.
- c) Two forces acting at and away from the point have magnitudes of 20kN and 25kN respectively having an included angle of 60° . Find their resultant in magnitude and direction.
- d) Calculate magnitude and direction of resultant for concurrent force system as shown in Fig. No.1.

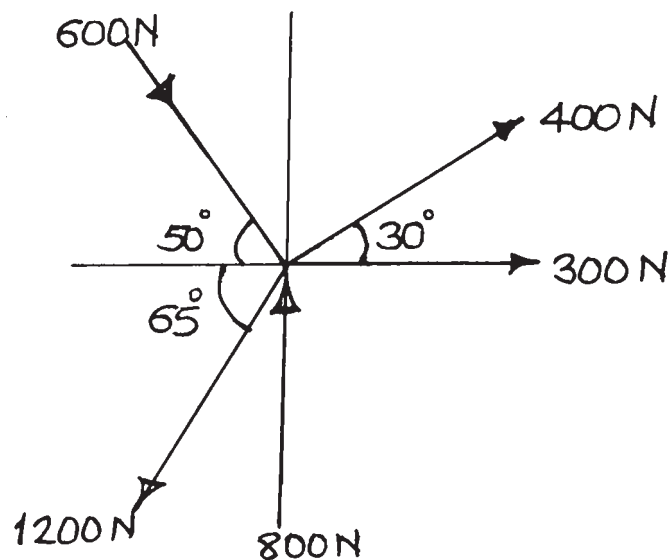


Fig. No. 1

- e) Write four characteristics of couple.
 f) Determine analytically magnitude, direction and position of resultant with respect to 5kN force shown in Figure No. 2.

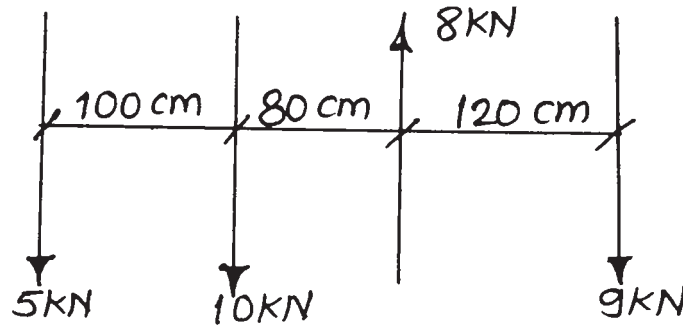


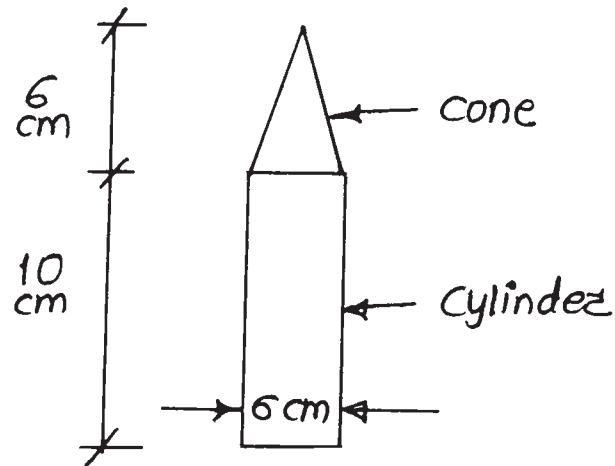
Fig. No. 2

3. Attempt any FOUR of the following: 16
- a) Differentiate between Resultant and Equilibrant.
 b) A sphere of weight 400N rests in a groove of smooth inclined surfaces making inclination of 30° and 60° with horizontal. Find reaction at contact surfaces.
 c) A simply supported beam of span 10 m carries at central a point load of 25kN and a udl of 25kN/m throughout. Find support reaction.
 d) A simply supported beam AB of span 8 m has two point loads of 6kN and 12kN at 4 m and 6 m from LHS. Calculate reactions at A and B.
 e) Define friction. List down its any three advantages.
 f) A block of 500N is kept on horizontal surface. A horizontal force of 150N is required to just move it. Find normal reaction, frictional resistance, resultant reaction and coefficient of friction.

4. Attempt any FOUR of the following:

16

- A body of weight 2000N rests on a horizontal plane. If the coefficient of friction is 0.4. Find the horizontal force required to move the body.
- A block of 80N is placed on a horizontal plane where the coefficient of friction is 0.25. Find the force at 30° up the horizontal to just move the block.
- State any four laws of static friction.
- Find the centroid of L section $90 \times 60 \times 8$ mm.
- Calculate centre of gravity for Fig. No.3.

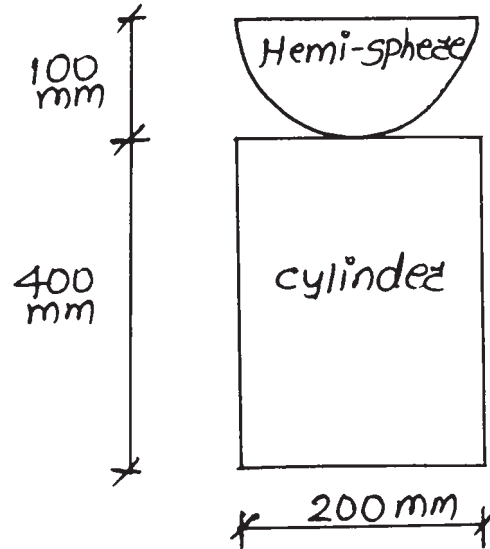
Fig. No. 3

- Define moment of inertia. Calculate radius of gyration for rectangular section.

5. Attempt any FOUR of the following:

16

- a) Find centre of gravity for the solid. Refer Fig. No 4.

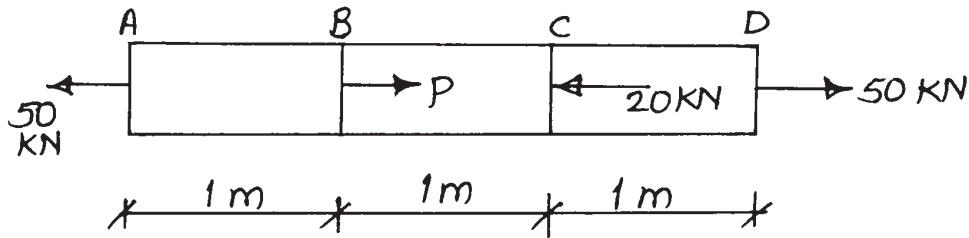
Fig. No. 4

- b) Give the values of moment of inertia (about xx and yy) for following sections.
- Triangle
 - Circle
- c) A screw jack has an effort wheel diameter of 300 mm and pitch is 6 mm. If a load of 1200N is lifted by an effort of 200N, find the efficiency of a machine.
- d) The diameter of wheel in a differential axle and wheel is 40 cm and that of axles are 10 cm and 8 cm. If an effort of 50N can lift a load of 1500N, Find the efficiency of the machine.
- e) A load of 1kN is lifted by an effort of 56N and 2kN load is lifted by an effort of 96N. calculate effort required to lift a load of 3kN.
- f) Give the formulae for following machines for calculating velocity ratio with the meaning of terms involved in it.
- Double purchase crab
 - Worm and worm wheel

6. Attempt any FOUR of the following:

16

- a) Draw and label the diagram for single purchase crab.
- b) Define:
 - (i) Bulk modulus
 - (ii) Modulus of rigidity.
- c) Draw the stress - strain curve for ductile material.
- d) List out assumptions made in theory of pure torsion.
- e) A circular bar having 200 mm^2 area is subjected to axial loads shown in Fig. No. 5. Find P and total elongation
Take $E = 2 \times 10^5 \text{ N/mm}^2$.

Fig. No. 5

- f) If $E = 2.5 (G)$, Find the value of Poisson's ratio.
