17204

21718

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.

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

Marks

1. Attempt any TEN of the following : **10 × 2 = 20**

(a) Define Mechanical Advantage (MA) & Velocity Ratio (VR).

(b) Define effort and state its SI units.

(c) Define ideal machine.

(d) Define force & state its SI units.

(e) State principle of transmissibility.

(f) Draw diagram of like parallel & unlike parallel force system.

(g) What is space diagram and vector diagram ?

(h) State Lami's theorem.

(i) State relation between resultant and equilibrant.

(j) Define angle of repore.

(k) State advantages of friction.

(l) State VR of screw jack and give the meaning of each terms used in it.

2. Attempt any FOUR : **4 × 4 = 16**

(a) The law of machine is P = 0.02 W + 30 N. It has velocity ratio of 82. Calculate effort & effort lost in friction for a load of 1200 kN.

(b) In a differential axle & wheel, the diameter of wheel is 400 mm & diameter of bigger axle is 100 mm and smaller axle is 80 mm. If an effort of 50 N can lift a load of 1500 N. Find the velocity ratio & efficiency of the machine.

(c) A screw jack has pitch of 5 mm and length of lever as 150 mm. An effort required to lift a load of 80 kN is 500 N. Calculate the efficiency and state the type of machine.

(d) Find the orthogonal component of the following forces :

(1) 300 N acting NE, (2) 500 N acting 30º west of south, (3) 25 N due south & (4) 50 N due North.

(e) Define couple and state any four properties of couple.

(f) Calculate the resultant in magnitude, direction and position with respect to 30 N force for the parallel forces system as shown in fig (I).

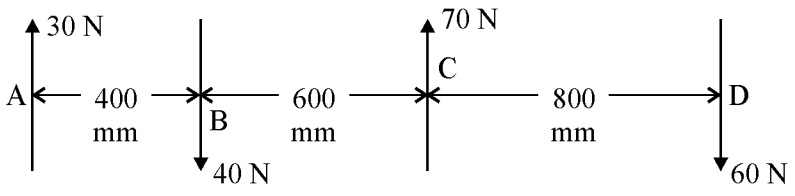

fig (I).

3. Attempt any FOUR : **4 × 4 = 16**

(a) Four forces act on a bar as shown in fig (II). Determine their resultant in magnitude and direction, if AB = 2 m, BC = 2 m, CD = 3 m.

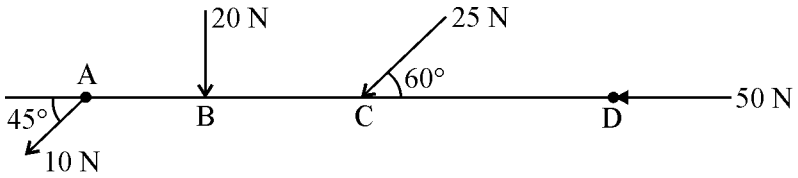

fig (II).

(b) Calculate the resultant of force system as shown in fig (III).

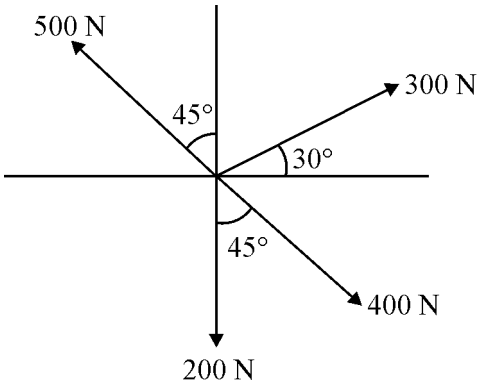

fig (III).

(c) Solve graphically Q. No. 3(b)

(d) Calculate the resultant of force system as shown in fig (IV). w.r.t. A point.

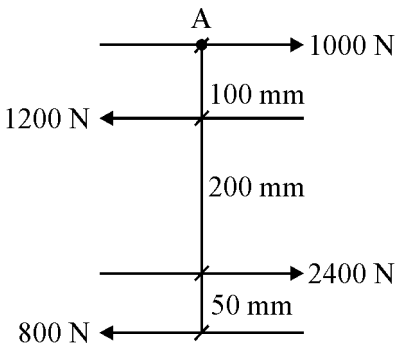

fig (IV).

P.T.O.

(e) Define space diagram, vector diagram. State the use of vector diagram in graphic statics.

(f) Two forces of magnitude 100 N pull and 80 N push are acting at a point making an angle of 135º between them. Find the resultant in magnitude & direction.

4. Attempt any FOUR : **4 × 4 = 16**

(a) Two cables are tied together at C and loaded as shown in fig (V). Determine the tension in cables AC & BC using Lami's theorem.

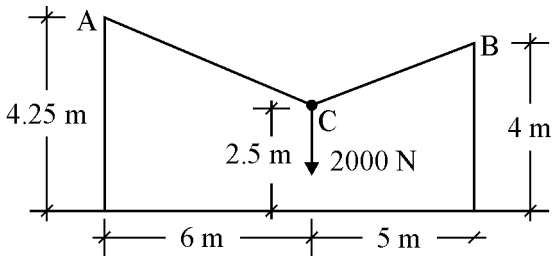

fig (V).

(b) State the relation between resultant and equilibrium. Also state analytical conditions of equilibrium for non-concurrent force system.

(c) A beam AB 6 m long rests on two supports 4 m apart the right hand end is over hanging by 2 m, the beam carries a udl of 4 kN/m over the entire span. Determine the reactions of supports.

(d) A beam AB is loaded as shown in fig (VI). Calculate the reactions at A & B.

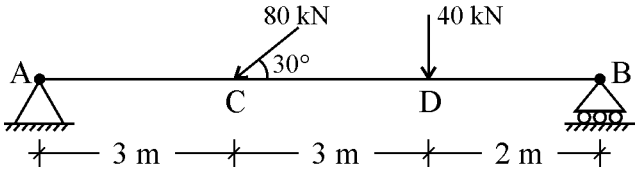

fig (VI).

(e) Calculate the reaction given by the plane at A & B supporting a 800 N sphere as shown in fig (VII).

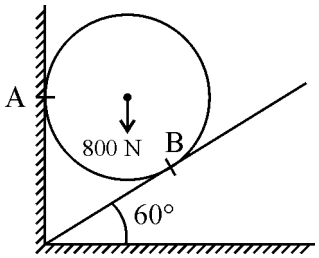

fig (VII).

(f) Solve Question No. 4 (d) graphically.

5. Attempt any FOUR : **4 × 4 = 16**

(a) A block of weight 200 N rest on a rough horizontal surface. Find the magnitude of the force to be applied at an angle of 30º to the horizontal in order to just move the body on the surface. Assume $\mu = 0.30$.

(b) A body of weight 300 N is resting on inclined plane making an angle of 30º to the horizontal. A pull of 80 N applied parallel & up the plane. Calculate co-efficient of friction and force of friction.

(c) A block weighing 50 N is resting on 30º rough inclined plane. A force of 12 N parallel to plane is applied to the block up the plane and the block is just on the point of moving down the plane. Find the co-efficient of friction.

(d) Draw a neat & labelled sketch of ladder friction. Show all forces acting on it.

(e) What do you understand by the term 'Reversibility' of a machine ? Explain the difference between a reversible and a self locking machine.

(f) In a machine, it was found that an effort had to be moved through a distance of 500 mm to move load by 50 mm. Using this machine a load of 10 kN was raised by an effort of 1.25 kN. Determine :

(i) Velocity ratio

(ii) Mechanical advantage

(iii) Efficiency

(iv) Effort lost in friction

6. Attempt any FOUR : **4 × 4 = 16**

(a) Determine centroid of T section with respect to bottom having flange 200 mm × 20 mm and web 20 × 200 mm.

(b) Locate the centroid of angle section ISA 150 × 150 × 10 mm.

(c) Calculate the $\overline{X}$ for the channel section as shown in fig. (VIII).

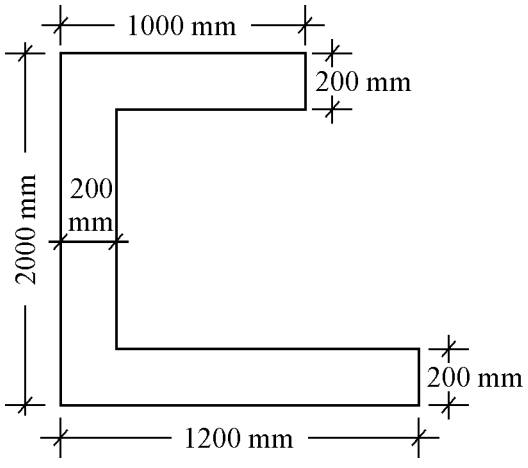

fig (VIII).

(d) A solid cone having base diameter 150 mm and height 150 mm is placed on top of cylinder of dia. 150 mm and height 200 mm such that axis are co-linear locate C.G. w.r.t. bottom.

(e) On a solid inverted cone 200 mm diameter and 600 mm height a sphere of 300 mm diameter is placed co-axially locate C.G. w.r.t. apex of cone.

(f) A right circular cone of base dia. 100 mm and height 200 mm is placed on the hemisphere of the same diameter. Calculate its C.G.
