

17204

**11920**

**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 :**

**10 × 2 = 20**

- (a) Define Mechanical Advantage (M.A.) and Velocity Ration (V.R.) in a simple machine.
- (b) Define effort and effort lost in friction.
- (c) Define Ideal machine and Ideal effort.

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**P.T.O.**

- (d) Define force and state its SI unit.
- (e) State principle of transmissibility.
- (f) State characteristics of a force.
- (g) What is space diagram and vector diagram ?
- (h) State Lamis theorem.
- (i) State Analytical condition of equilibitions for non-concurrent force system.
- (j) State any two advantages of friction.
- (k) Define coefficient of friction.
- (l) State velocity ratio for simple screw jack with meaning of each term involved.

**2. Attempt any FOUR :**

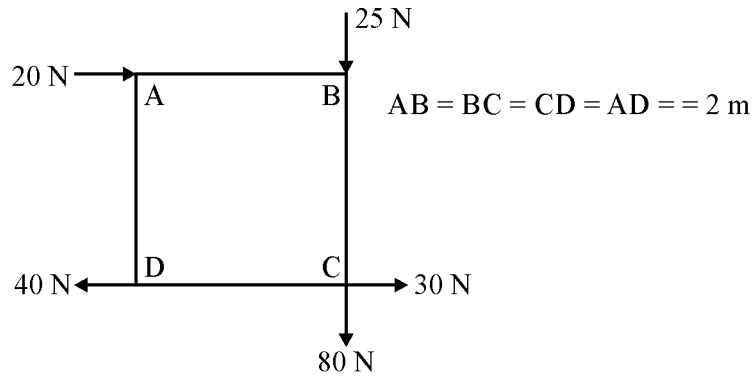
**4 × 4 = 16**

- (a) In a certain lifting machine effort was found to move a distance of 30 m, when the load moved through a distance of 1.5 m. If the machine is Ideal, find V.R. and M.A. of the machine.
- (b) A machine has V.R. = 25 and law of machine is  $P = (0.01W + 5)$  N. Find M.A. efficiency and effort lost in friction when load is 1000 N. Also, state the machine is reversible or not.
- (c) In a single purchase crab winch number of teeth on pinion is 25 and that on spur wheel are 100, radius of load drum is 50 mm and radius of effect wheel is 300 mm. Find the efficiency of machine and effect lost in friction if effort of 20 N can lift a load of 40 N.

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- (d) Resolve force of 100 N magnitude passing through co-ordinate (0, 0) & (0, -2).
- (e) Find the moment about point 'B' as shown in fig.

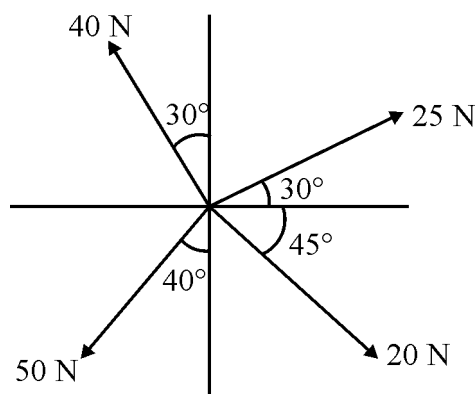


- (f) Define couple. State its SI unit and state properties of couple.

3. Attempt any FOUR :

$4 \times 4 = 16$

- (a) Find the magnitude and direction of resultant force of the force system as shown in fig. (Use Analytical method).



P.T.O.

(b) Find the resultant in magnitude and direction if following forces acting away from a point :

(i) 300 N acting  $30^\circ$  East of North

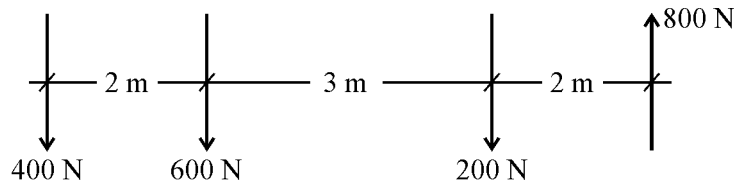
(ii) 150 N acting  $45^\circ$  West of North

(iii) 200 N acting towards West

(iv) 400 N acting  $30^\circ$  West of South.

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

(d) Calculate resultant Direction and its position w.r.t. 400 N force for a given force system as shown in fig.



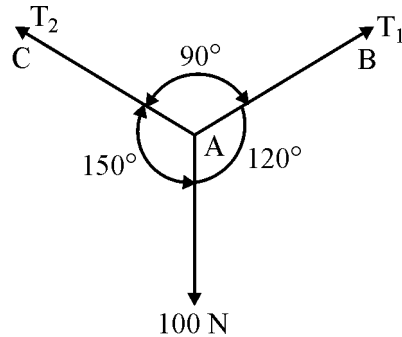
(e) Solve Q. No. 3(d) graphically.

(f) Five forces of magnitude 10N, 20N, 30N, 40N and 50N starting from one corner of regular hexagon and acts towards its other corner taken in anticlockwise order. Determine magnitude and direction of resultant analytically. (Regular hexajon placed such that its one of side is horizontal)

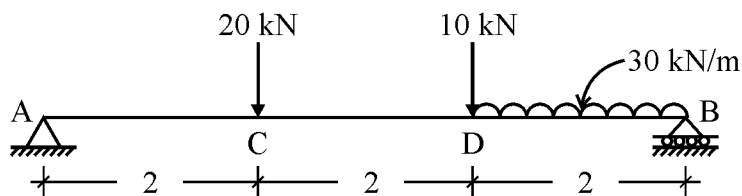
4. Attempt any FOUR :

4 × 4 = 16

- (a) Find the tension in the string as shown in fig.



- (b) An electric bulb weighing 30N hangs from a ceiling by two strings AC & BC where AC is inclined at  $60^\circ$  to ceiling and BC at  $40^\circ$  to the vertical wall at B. Determine the forces in the strings AC & BC.
- (c) A simply supported beam has a span of 6 m. Find the position of a point load on it such that the left hand reaction is three times the right hand reaction.
- (d) Find the support reaction of simply supported beam as shown in fig.



- (e) A sphere of weight 1000 N rests in a groove of smooth inclined surface which are making  $60^\circ$  and  $30^\circ$  inclination with horizontal. Find the reactions at the contact surfaces.
- (f) Solve Q. No. 4(d) graphically.

P.T.O.

**5. Attempt any FOUR :****4 × 4 = 16**

- (a) A body of weight 1000 N rests on a horizontal plane. If the coefficient of friction is 0.4. Find the horizontal force required to move the body.
- (b) A block weighing 500 N is resting on an inclined plane making an angle  $30^\circ$  with the horizontal. Calculate the pull applied parallel to the plane to move the block up the plane if  $\mu = 0.30$ .
- (c) A body of weight 800 N is resting on a rough inclined plane of  $40^\circ$ . If the  $\mu = 0.50$  what force is required to prevent the body from falling down the plane.
- (d) Draw Free Body Diagram (FBD) of a ladder resting against a wall and floor having weight  $W$ . Assume floor surface is smooth.
- (e) The following are the observations made on certain machine having  $VR = 40$ . Find the law of machine.

<b>Load W(N)</b>	0	10	25	40	80
<b>Effort P(N)</b>	3	4	6	8	10

- (f) Draw a neat labelled sketch of differential axle & wheel and state V.R. formula.

**6. Attempt any FOUR :****4 × 4 = 16**

- (a) Locate the centroid of equal Angle ISA  $100 \times 100 \times 10$  mm.
- (b) Find the centroid of inverted T section having flange  $120 \times 20$  mm and web  $180 \times 20$  mm.
- (c) Calculate and locate the centroid of lamina from base having following dimensions: base width 150 mm, Top width 100 mm height of left vertical side of lamina is 500 mm. Right side of lamina is inclined.

- (d) A solid cone having base dia. 60 mm and height 60 mm is kept co-axially on a solid cylinder having same diameter and height 100 mm. Find centre of gravity of combination.
- (e) A frustum of a cone has top diameter 100 cm and bottom diameter 200 cm. with height 300 cm. Find centre of gravity.
- (f) Locate the c.g. of compose figure as show in fig.

