

17204

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 :

10 × 2 = 20

- (a) Define the ideal machine and ideal effort.
- (b) Define effort lost in friction with formula.
- (c) State V.R. of differential axle and wheel.
- (d) Define statics and dynamics.
- (e) State the principle of transmissibility of a force.
- (f) State Varignon's theorem of moments.
- (g) State the relation between resultant and equilibrant.
- (h) Define angle of repose.
- (i) Draw F.B.D. for a ladder having weight 'W'.
- (j) State Lami's theorem.
- (k) State the parallelogram law of forces.
- (l) State the graphical conditions of equilibrium.

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P.T.O.

2. Attempt any FOUR of the following :

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- A certain machine has an efficiency of 48%. The velocity ratio of the machine is 200. Find the effort required to lift a load of 2 kN using this machine.
- An effort of 800 N is required to lift a load of 10 kN. On this machine an effort of 1400 N, lifts a load of 22 kN. Find the law of machine.
- A screw jack lifts a load of 30 kN by an effort of 400 N applied at the end of lever arm of length 750 mm. If the pitch of screw is 6 mm. Calculate efficiency of the screw jack.
- A machine has $VR = 25$ and law of machine is $P = (0.01 W + 5)N$. Find MA , efficiency and effort lost in friction when load is 1000 N, also state whether the machine is reversible or not.
- Resolve a force of 500 N into two directions at 30° and 45° on either side of it.
- Determine the resultant moment of the forces about point 'A' in fig. 1.

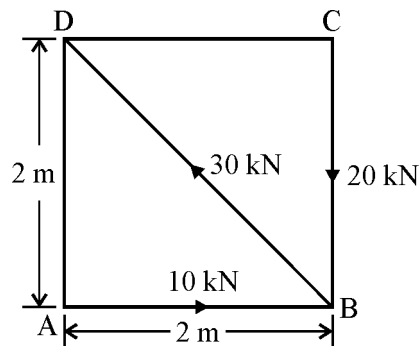


Fig. - 1

3. Solve any FOUR :

16

- Find the components of 60 N force acting horizontal, in two directions on either side at an angle of 30° each.
- Find the resultant force and its directions if two forces 20 N and 40 N is acting along the adjacent sides of a parallelogram making an angle of 60° .
- Five parallel forces of magnitude 20, 40, 60, 80 and 100 kN are acting on a beam. Distance of forces from 20 kN force are 1 m, 2 m, 3 m and 4 m respectively. Forces of 40 kN and 80 kN are acting vertically downwards. Other pointing upwards. Find the resultant in magnitude and direction and locate its position with respect to 20 kN force.

- (d) Solve Q. 3(c) graphically
- (e) Resolve each of the following forces into orthogonal components :
 - (i) 350 N acting – South-West away
 - (ii) 200 N acting – North-East away
 - (iii) 40 N acting 40° West of South away
 - (iv) 400 N acting due South way
- (f) Explain the following :
 - (i) Resolution of a force
 - (ii) Composition of force

4. Attempt any FOUR of the following :

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- (a) A triangle ABC of 1 m side is subjected to forces of 10 N, 20 N, 30 N along AB, BC & AC respectively. Find the magnitude direction and locate the position of it from A.
- (b) A sphere of weight 450 kN vests in a groove of smooth inclined surfaces which are making 60° and 30° inclination with horizontal. Find the reactions at the contact surfaces.
- (c) A beam of span 4 m is simply supported at its end. It carries a concentrated load of 40 kN and 20 kN at 1 m and 2 m from the left hand support respectively. It carries a udl of 10 kN/m for 2 m from the right end. Determine the reactions at supports.
- (d) Solve Q. 4(c) by graphical method.
- (e) A simply supported beam of span 10 m carries a centre load of 25 kN and a u.d.l. of 25 kN/m throughout. Find support reaction.
- (f) Distinguish between resultant and equilibrant.

P.T.O.

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

- (a) A body of weight 2000 N rest on a horizontal plane. If the coefficient of friction is 0.4. Find the horizontal force required to move the body.
- (b) A block of 100 N 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.
- (c) A block of 400 N is kept on 40° inclined plane find the force, applied parallel to plane, require to just move the block up the plane. Coefficient of friction is 0.27.
- (d) Draw FBD of a ladder resting against a wall and floor having weight W.
- (e) State the procedure to draw funicular polygon with resultant of concurrent and parallel force system.
- (f) A certain machine has a velocity ratio 20. If the load of 100 N is lifted by an effort of 25 N. Find the mechanical advantage and efficiency of machine.

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

- (a) Locate the centroid of 'T' section $100 \times 100 \times 10$ mm having total depth of 100 mm.
 - (b) Find the position of centroid of an unequal angle section with dimensions $200 \text{ mm} \times 150 \text{ mm} \times 10 \text{ mm}$. Longer leg is vertical.
 - (c) A solid forming a cone of base 100 mm and height 200 mm joins to base with cylinder of base 100 mm and height 200 mm. Compute the position of C.G.
 - (d) A hemisphere of diameter 100 mm is placed on the top of cylinder whose diameter is also 100 mm. If the C.G. of the composite solid is 77.22 mm from the bottom of the cylinder. Find the height of the cylinder.
 - (e) Define centroid. Show on sketch the C.G. of a semicircle of diameter 200 mm.
 - (f) The frustum of a cone has top diameter 40 cm and bottom diameter 60 cm with height 18 cm. Calculate is depth.
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