

19203

21718

3 Hours / 100 Marks

Seat No.

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- Instructions :**
- (1) All Questions are *compulsory*.
 - (2) Illustrate your answers with neat sketches wherever necessary.
 - (3) Figures to the right indicate full marks.
 - (4) Assume suitable data, if necessary.
 - (5) Use of Non-programmable Electronic Pocket Calculator is permissible.
 - (6) 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 Statics.
- (b) Define Equilibrant.
- (c) Define Free body diagram.
- (d) Define Centroid.
- (e) Define Centre of gravity.
- (f) Differentiate between fundamental & derived units.

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- (g) Define rigid body.
- (h) Define Kinematics.
- (i) State the principle of transmissibility.
- (j) Define Moment.
- (k) Differentiate between Resultant & Equilibrant.
- (l) Define mass & weight.
- (m) Define Couple.

2. Attempt any FOUR of the following :

$4 \times 4 = 16$

- (a) Calculate the moment about point B for the force system shown in fig. 1.

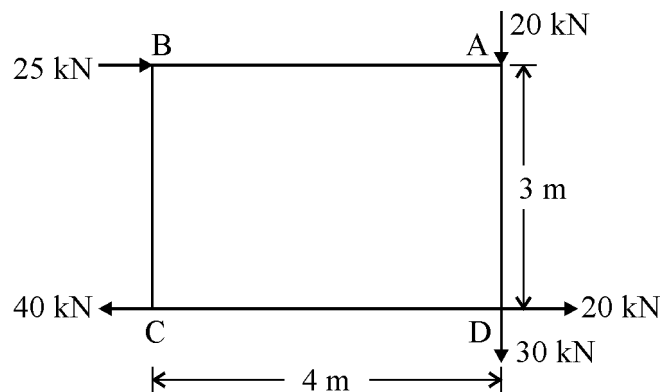


Fig. – 1

- (b) Forces of 1kN, 2kN, 3kN & 4 kN are acting at a point in the directions North East, North West, South West & South East. Find magnitude, direction & position of resultant.

- (c) Calculate magnitude & position of resultant from 25 kN for the force system shown in fig. 2.

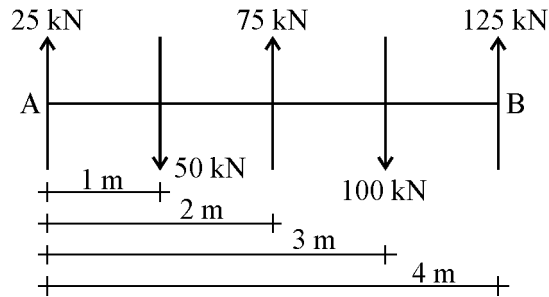


Fig. – 2

- (d) State properties of couple.
 (e) State & explain law of parallelogram of forces.
 (f) Resolve the force 400 N into two directions at 45° & 60° on either side of bit.

3. Attempt any FOUR of the following :

$4 \times 4 = 16$

- (a) A system of coplanar, non-concurrent forces is shown in fig 3. Determine the resultant in magnitude & direction with respect to pt. A.

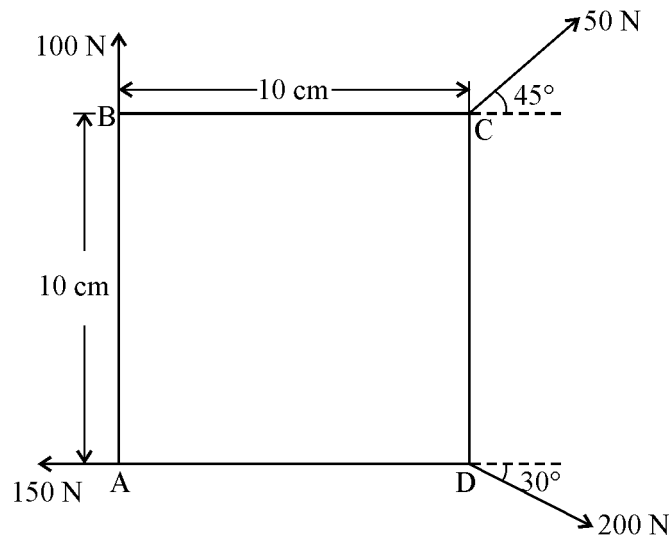


Fig. – 3

- (b) Three equal forces of magnitude P each diverge from a point, the middle one being inclined at 60° to the others. Find the resultant force.
- (c) Find the orthogonal components of each of the following forces :
- 350 N acting 40° West of South
 - 400 N acting due South
 - 200 N acting North East
 - 40 N acting due East
- (d) Forces of 3, 6, 9 & 12 kN respectively acts on a regular pentagon as shown in fig. 4. Find the resultant in magnitude & direction.

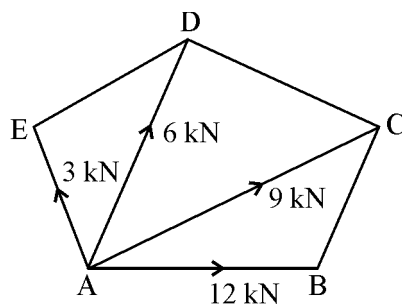


Fig. – 4

- (e) Two forces $8P$ & $6P$ respectively act on a particle at an angle θ . If $8P$ is increased by 25% & $6P$ by 15N without any change in direction of resultant remaining unchanged. Find value of P .
- (f) State parallelogram law of forces & derive the equations for magnitude & directions of resultant force.

4. Attempt any FOUR of the following :

4 × 4 = 16

- Explain Vector diagram & Polar diagram.
- Explain types of beam with neat sketch.
- A simply supported beam of span 8 m carries point loads of 2 kN, 3kN, 4 kN & 5 kN at 1 m, 3 m, 5 m & 7 m from left support. Find the support reactions.
- A simply supported beam of 4 m span is loaded with an udl of 5 kN/m for 2 m sfrom left end & a pt. load of 30 kN at 1m from right end. Find reactions.
- Solve Q.4 (d) with graphical method.
- Draw neat sketch of (i) Cantilever beam with udl through its length
(ii) Simply supported beam with one point load at center & udl half of its length from left support.

5. Attempt any FOUR of the following :

4 × 4 = 16

- A smooth sphere weighing 500 N is resting in a trough as shown in fig. 5. Determine reaction at point of contact.

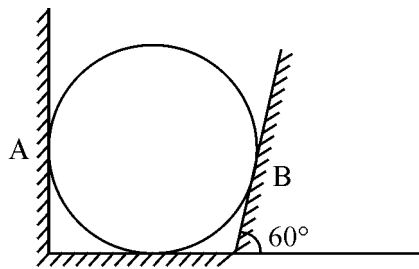


Fig. – 5

- What is Lami's theorem ? State its limitations.
- Define : (i) Point load (ii) Uniformly distributed load.

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- (d) If pulley is at rest, what are values of T_1 & T_2 ? Explain why. Refer fig. 6.

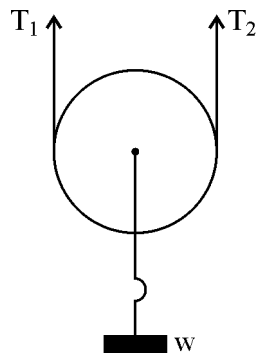


Fig. – 6

- (e) Differentiate between centroid & centre of gravity.
- (f) Indicate the centroid of following plane geometrical figures (i) Equilateral triangle (ii) Quarter circle.

6. Attempt any FOUR of the following :

4 × 4 = 16

- (a) Find centroid of I section as shown in fig. 7.

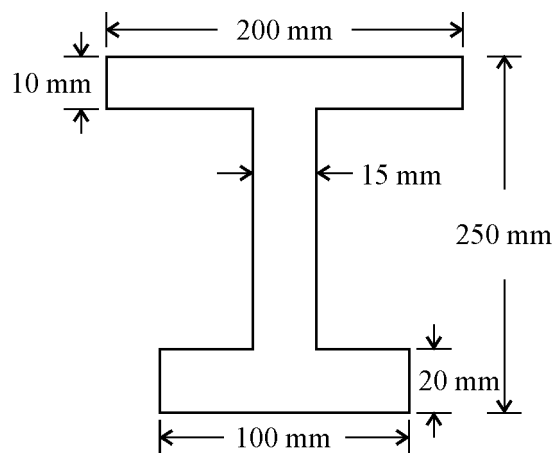


Fig. – 7

- (b) Locate centroid of equal angle 100 mm × 100 mm × 10 mm.

- (c) Locate centroid of shaded area as shown in fig. 8.

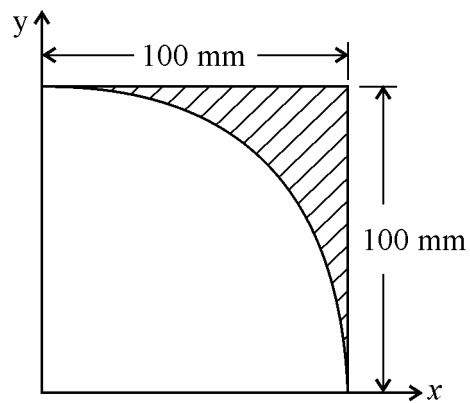


Fig. – 8

- (d) Locate the C.G. of L section having flange 10×100 mm & web 10×80 mm.
- (e) A cone of diameter 4 cm & height 4 cm is cut-off from a cylinder of diameter 4 cm & height 6 cm. Find the position of C.G. of remainder from the base.
- (f) A hemisphere of dia. 100 mm is placed on the top of cylinder whose diameter is also 100 mm. Find the C.G. of composite solid from the base of the cylinder if its height is 120 mm.

