



- 3 a. Choose your answers for the following : (04 Marks)
- Lines of action of all forces pass through a single point and all forces lie in the same plane. Such forces are called
 

A) Coplanar concurrent forces	B) Coplanar non concurrent forces
C) Non coplanar concurrent forces	D) Collinear forces.
  - The method to resolve a single force in two mutual perpendicular directions is called
 

A) Composition of forces	B) Resolution of forces
C) Moment	D) All of the above
  - Resultant of two forces shown in Fig. Q3(a) is
 

A) 1000 kN	B) 1400 kN	C) 1100 kN	D) 1200 kN
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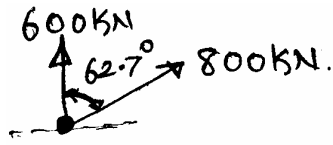


Fig. Q3(a)

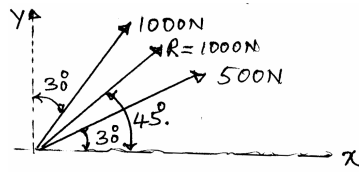


Fig. 3(b)

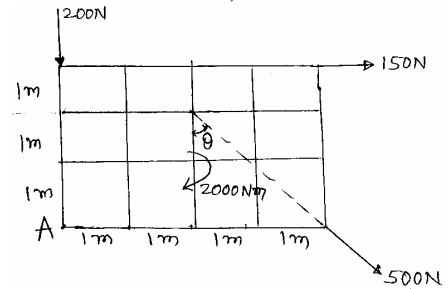


Fig. Q3(c)

- Two forces of equal magnitude  $P$  act at angle ' $\theta$ ' to each other. What will be their resultant?
 

A) $P \cos \theta/2$	B) $2P \cos \theta$	C) $2P \cos \theta/2$	D) $P \cos \theta$ .
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- b. Two forces acting on a body are 500 N and 1000 N as shown in Fig. Q3(b). Determine the third force  $F$  such that the resultant of all three forces is 1000 N directed at  $45^\circ$  to the  $x$ -axis. (06 Marks)
- c. Find the equilibrant with respect to A as origin for the system of forces shown in Fig. Q 3(c). (10 Marks)
- 4 a. Choose your answers for the following : (04 Marks)
- Point where the whole weight of body acts at
 

A) Centroid	B) Centre of gravity
C) Axis of reference	D) Second moment of area
  - The distance of centroid of quarter circle from its diameters are
 

A) $\frac{4r}{3\pi}$	B) $r$	C) $\frac{\pi r^4}{4}$	D) $\frac{3r}{4\pi}$
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  - Height of centroid of a triangle of height ' $h$ ' from its base is
 

A) $\frac{h}{2}$	B) $\frac{2}{3}h$	C) $\frac{h}{3}$	D) $\frac{3h}{4}$
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  - The centroid of a plane lamina will not be at its geometrical centre if it is a
 

A) Circle	B) Right angled triangle
C) Rectangle	D) Equilateral triangle
- b. Locate the centroid of a semicircle by the method of integration. (06 Marks)
- c. Locate the centroid of the shaded area shown in Fig. Q4(c). (10 Marks)

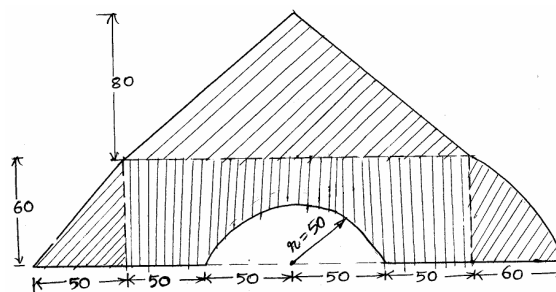


Fig. Q4(c)

PART – B

- 5 a. Choose your answers for the following : (04 Marks)
- i) Relation between action and reaction force is
    - A) They are equal in magnitude and opposite in direction
    - B) They have common line of action
    - C) Act perpendicular to the line of contact
    - D) All the above
  - ii) The non-applied forces are
    - A) Self weight      B) Reaction      C) Both A and B      D) None of these
  - iii) A force which nullifies the effect of forces is called
    - A) Equilibrium      B) Equilibrant      C) Resultant      D) None of these
  - iv) A system that possesses a resultant
    - A) Will be in equilibrium      B) Will be under rest
    - C) Not be in equilibrium      D) None of these
- b. State Lami's theorem. (02 Marks)
- c. A sphere of weight 5 kN is supported by the Pulley 'P' and 2 kN weight passing over a smooth pulley as shown in Fig. Q5(c). If  $\alpha = 30^\circ$ , calculate the value of P and  $\theta$ . (06 Marks)

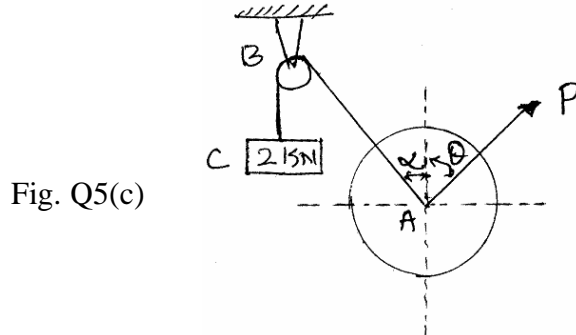


Fig. Q5(c)

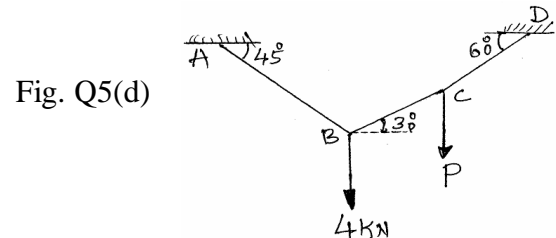


Fig. Q5(d)

- d. A string is subjected to the forces 4 kN and P as shown in Fig. Q5(d). Determine the magnitudes of P and tension forces induced in various portions of the string. (08 Marks)
- 6 a. Choose your answers for the following : (04 Marks)
- i) A beam which has one end fixed and other end simply supported is called
    - A) Fixed beam      B) Simply supported beam
    - C) Propped cantilever beam      D) Cantilever beam
  - ii) If the intensity of load increases linearly along the length of beam, it is
    - A) Uniformly distributed load      B) Uniformly varying load
    - C) Moment      D) General loading
  - iii) A statically indeterminate beam is a
    - A) Cantilever beam      B) Simply supported beam
    - C) Double over hanging beam      D) Continuous beam
  - iv) A support, where two reaction components exist which are mutually perpendicular, is
    - A) Simple support      B) Roller support      C) Hinge support      D) Fixed support.
- b. Find the support reaction for the cantilever beam loaded as shown in Fig. Q6(b). (08 Marks)

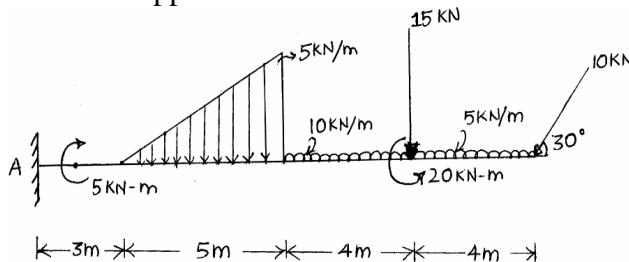


Fig. Q6(b)

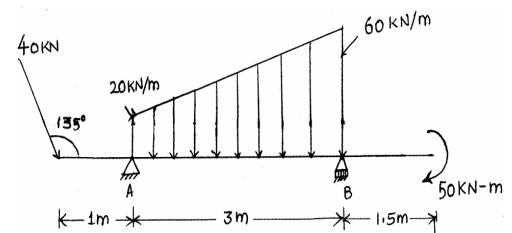
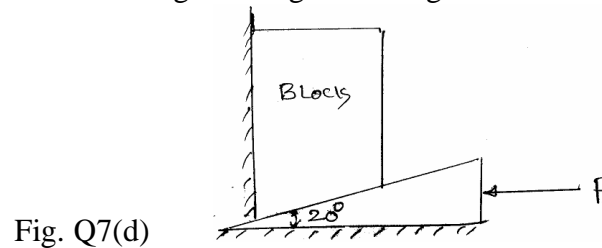


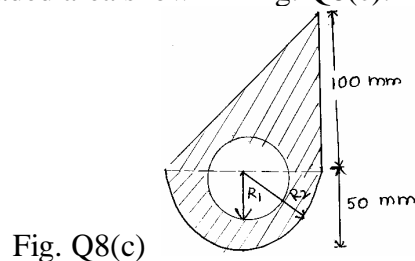
Fig. Q6(c)

- c. Determine the reaction at the supports A and B for a beam loaded as shown in Fig. Q6(c). (08 Marks)

- 7 a. Choose your answers for the following : (04 Marks)
- Friction acting on a body which is just on the point or verge of sliding is called
    - Limiting friction
    - Sliding friction
    - Co-efficient of friction
    - Cone friction
  - Friction acting on a body when the contact surfaces are completely separated by lubricant is called.
    - Non viscous friction
    - Film friction
    - Viscous friction
    - Dry friction
  - Friction force always acts
    - Opposite to the motion of the body
    - Along the motion of the body
    - Perpendicular to the motion
    - None of these
  - The coefficient of friction is equal to
    - The tangent of cone of friction
    - The tangent of angle of friction
    - The tangent of angle of repose
    - The ratio of resultant to normal.
- b. State the laws of friction (04 Marks)
- c. Define : i) Angle of friction ii) Co-efficient of striction. (02 Marks)
- d. A block weighting 10 kN is to be raised by means of 20° wedge as shown in Fig. Q7(d). Find the horizontal force P, which will just raise the block. Assume co-efficient of friction for all surfaces of contact is 0.3. Neglect weight of wedge. (10 Marks)



- 8 a. Choose your answers for the following : (04 Marks)
- Area moment of inertia is
    - First moment of area
    - Second moment of area
    - Radius of gyration
    - Area of cross section
  - Radius of Gyration is given by
    - $K = \sqrt{\frac{I}{A}}$
    - $K = \sqrt{\frac{A}{I}}$
    - $K = \sqrt{\frac{I}{Y}}$
    - $K = I \times A$
  - Moment of inertia of a triangle about its base is
    - $\frac{bh^3}{36}$
    - $\frac{bh^3}{12}$
    - $\frac{hb^3}{48}$
    - $\frac{hb^3}{36}$
  - Algebraic sum of first moment of elemental areas of plane figures about centroidal axis is always
    - Unity
    - Zero
    - Total area of elements
    - Moment of inertia.
- b. State and prove perpendicular axis theorem. (04 Marks)
- c. Determine the second moment of area and radius of gyration about the horizontal centroidal axis for the shaded area shown in Fig. Q8(c). (12 Marks)



$R_1 = 20 \text{ mm,}$   
 $R_2 = 50 \text{ mm,}$   
 $R_1 = \text{Radius of circle,}$   
 $R_2 = \text{Radius of semi circle}$