USN | | | | | | | | | 10CIV13/23

First/Second Semester B.E. Degree Examination, June/July 2013
Elements of Civil Engineering and Engineering Mechanics

Time: 3 hrs.   Max. Marks:100

Note: 1. *Answer any FIVE full questions, choosing at least two from each part.*
    2. *Answer all objective type questions only on OMR sheet page 5 of the answer booklet.*
    3. *Answer to objective type questions on sheets other than OMR will not be valued.*
    4. *Assume missing data suitably.*

PART – A

1   a.   Choose the correct answers for the following :   **(04 Marks)**
     i)   Geotechnical engineering involves the study of,
        A) Water   B) Soil   C) Air   D) All of these
     ii)   By-pass road is constructed,
        A) Inside the city   B) Over the main road
        C) Around the city   D) None of these
     iii)   The part of civil engineering which deals with waste water and solid waste is called,
        A) Water supply engineering   B) Geotechnical engineering
        C) Sanitary engineering   D) Structural engineering
     iv)   A bascule bridge is a,
        A) Floating bridge   B) Arch bridge   C) Suspension bridge   D) Movable bridge
   b.   Write a note on role of civil engineer in infrastructural development.   **(10 Marks)**
   c.   Name the different types of roads as per Nagpur plan.   **(06 Marks)**

2   a.   Choose the correct answers for the following :   **(04 Marks)**
     i)   Moment of a force can be defined as the product of force and _____ distance from the line of action of force to the moment center.
        A) Least   B) Maximum   C) Any   D) None of these
     ii)   Effect of force on a body depends on,
        A) Direction   B) Magnitude   C) Position   D) All of these
     iii)   The forces which meet at one point have their line of action in different plane are called,
        A) Coplanar concurrent forces   B) Non coplanar concurrent forces
        C) Non coplanar non concurrent forces   D) None of these
     iv)   Couple means two forces acting parallel,
        A) Equal in magnitude and in the same direction.
        B) Not equal in magnitude but in the same direction.
        C) Equal in magnitude but opposite in direction.
        D) None of these
   b.   Define force and state its characteristics.   **(06 Marks)**
   c.   Determine the magnitude and direction of the resultant for the system of forces shown in Fig. Q2 (c). Use classical method.   **(10 Marks)**
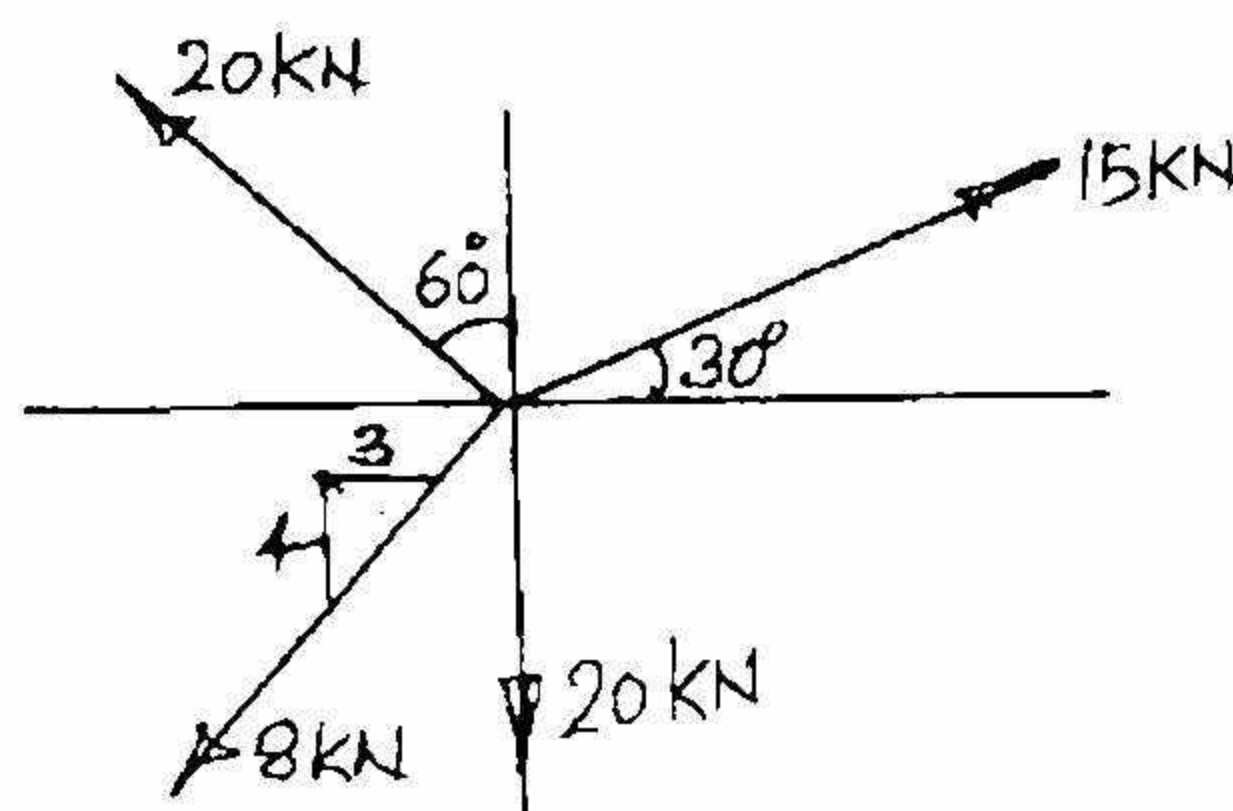

Fig. Q2 (c)

3   a.   Choose the correct answers for the following :   **(04 Marks)**
  - i)   The technology of finding the resultant of a system of forces is called,
    A) Resultant   B) Resolution   C) Composition   D) None of these
  - ii)   Equilibriant in nothing but a resultant,
    A) Equal in magnitude and in the same direction.
    B) Equal in magnitude but opposite in direction.
    C) Not equal in magnitude but in the same direction.
    D) Not equal in magnitude and opposite in direction.
  - iii)   If two forces P and Q (P > Q) act on the same straight line but in opposite direction their resultant is
    A) P + Q   B) P/Q   C) Q – P   D) P – Q
  - iv)   In coplanar concurrent force system if $\Sigma H = 0$ then the resultant is
    A) Horizontal   B) Vertical   C) Moment   D) None of these

     b.   State and prove Varignon's theorem of the moments.   **(06 Marks)**

     c.   Two spheres each of radius 100mm and weight 5kN is in a rectangular box as shown in Fig. Q3 (c). Calculate the reactions at the point of contacts.   **(10 Marks)**
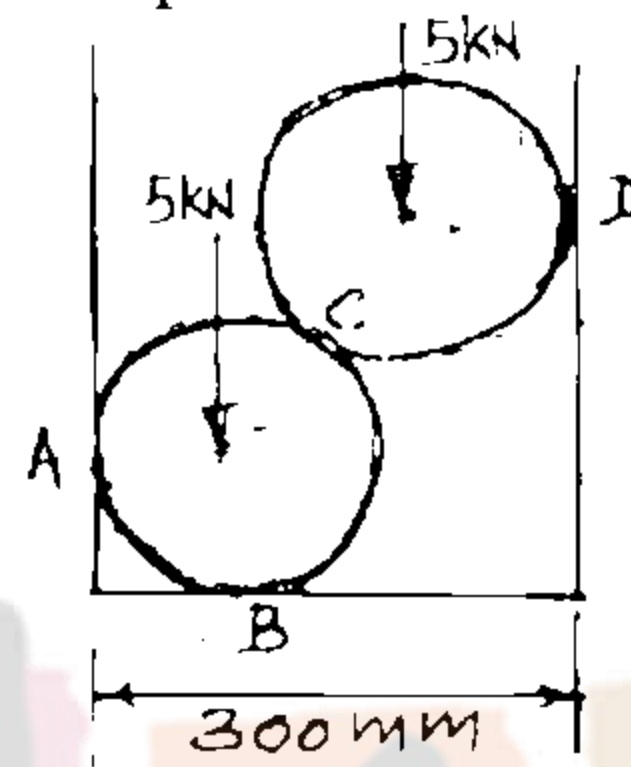

Fig. Q3 (c)

4   a.   Choose the correct answers for the following :   **(04 Marks)**
  - i)   Moment of total area about its centroidal axis is
    A) Twice the area   B) Three times the area   C) Zero   D) None of these
  - ii)   The centroid of a semicircle of radius R about its centroidal axis parallel to its diametric axis is
    A) $3R/4\pi$ B) $3R/8\pi$ C) $4R/\pi$ D) $4R/3\pi$
  - iii)   An axis over which one half of the plane figure is just mirror of the other half which is
    A) Bottom most axis of the figure   B) Axis of symmetry
    C) Unsymmetrical axis   D) None of these
  - iv)   Centroid of a rectangle of base width b and depth d is
    A) b/3 and d/3   B) b/2 and d/2   C) b/4 and d/4   D) None of these.

     b.   Determine the centroid of a triangle by the method of integration.   **(06 Marks)**

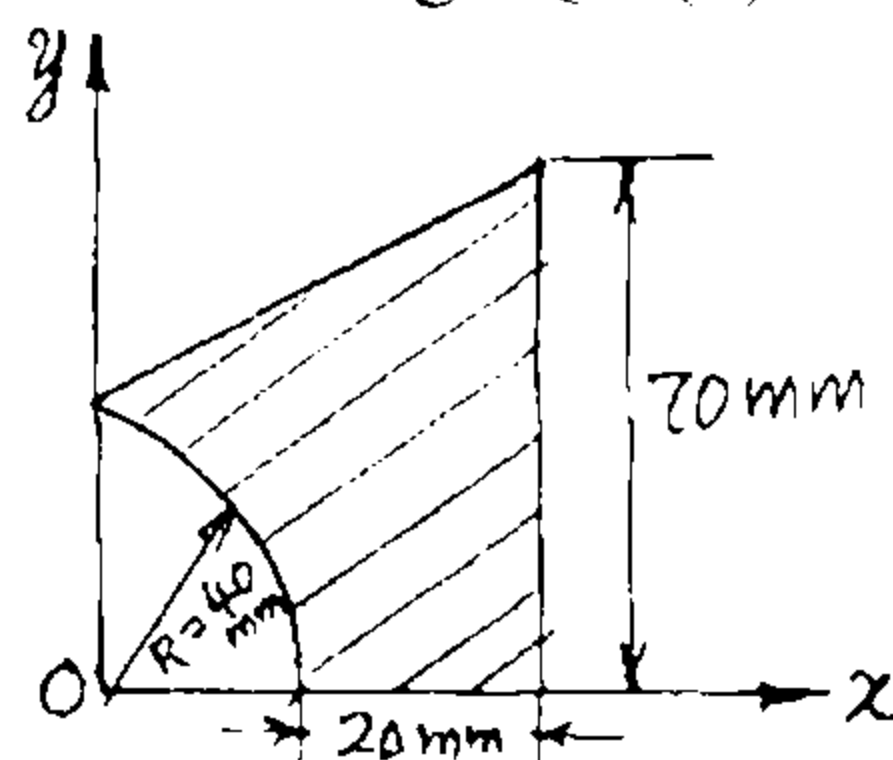   c.   Locate the centroid of the lamina shown in Fig. Q4 (c) with respect to point 0.   **(10 Marks)**

Fig. Q4 (c)

PART – B

5   a.   Choose the correct answers for the following :   **(04 Marks)**
  - i)   The necessary condition of equilibrium of a coplanar concurrent force system is algebraic sum of _____ must be zero.
    A) Horizontal and vertical forces   B) Moment of forces
    C) Horizontal, vertical and moment of forces   D) None of these

Q5 (a) Contd....

ii) In non concurrent force system if $\sum H = 0, \sum V = 0$ then the resultant is
   A) Horizontal   B) Vertical   C) Moment   D) Zero

iii) The force which is equal and opposite to the resultant is
   A) Resultant force   B) Force   C) Equilibriant   D) None of these

iv) The procedure of resolution is
   A) To find the resultant of the force system
   B) To break up an inclined force in to two components
   C) To find the equilibriant
   D) None of these

b. Determine the reactions at the point of contact for the sphere shown in Fig. Q5 (b). **(06 Marks)**
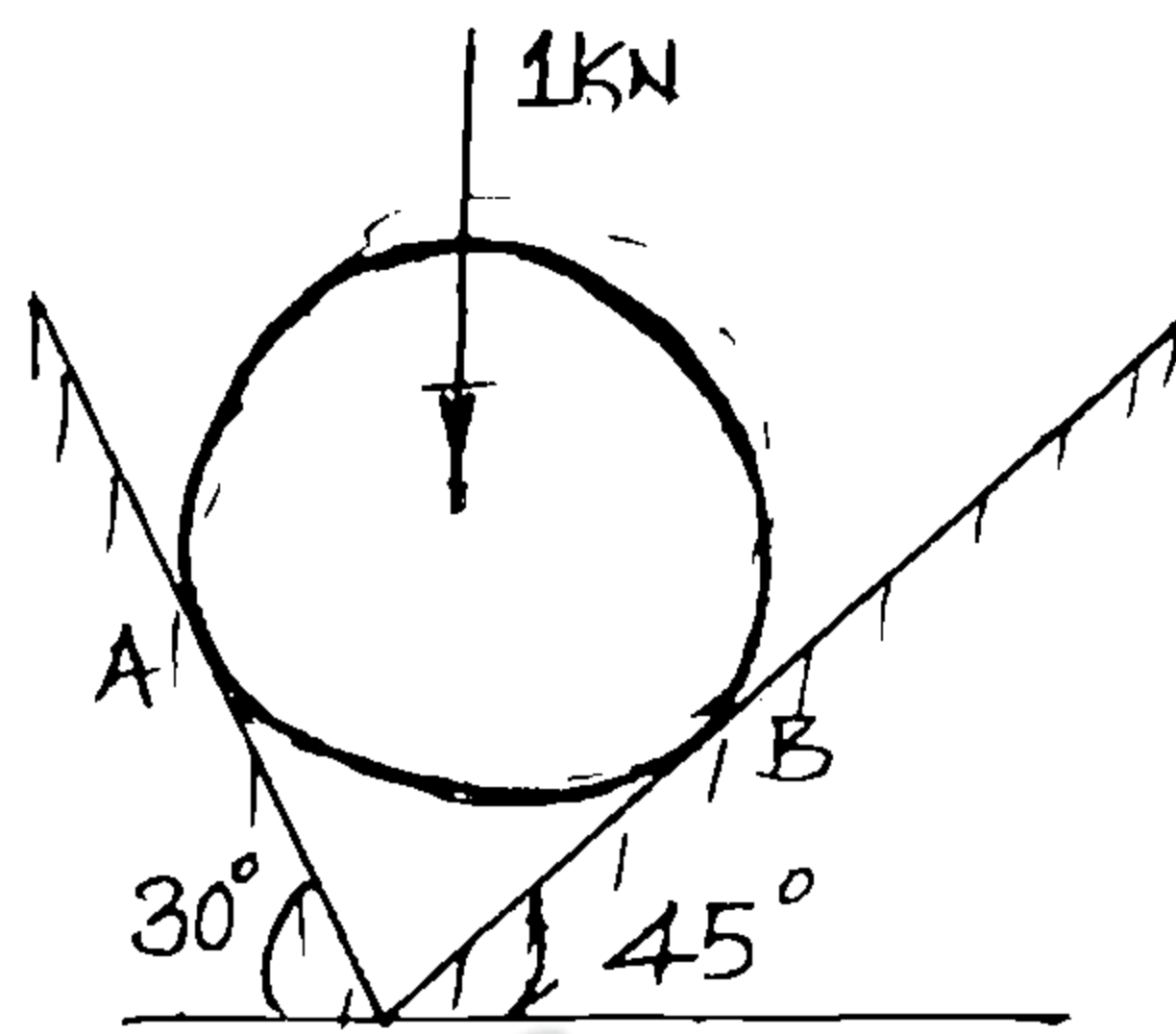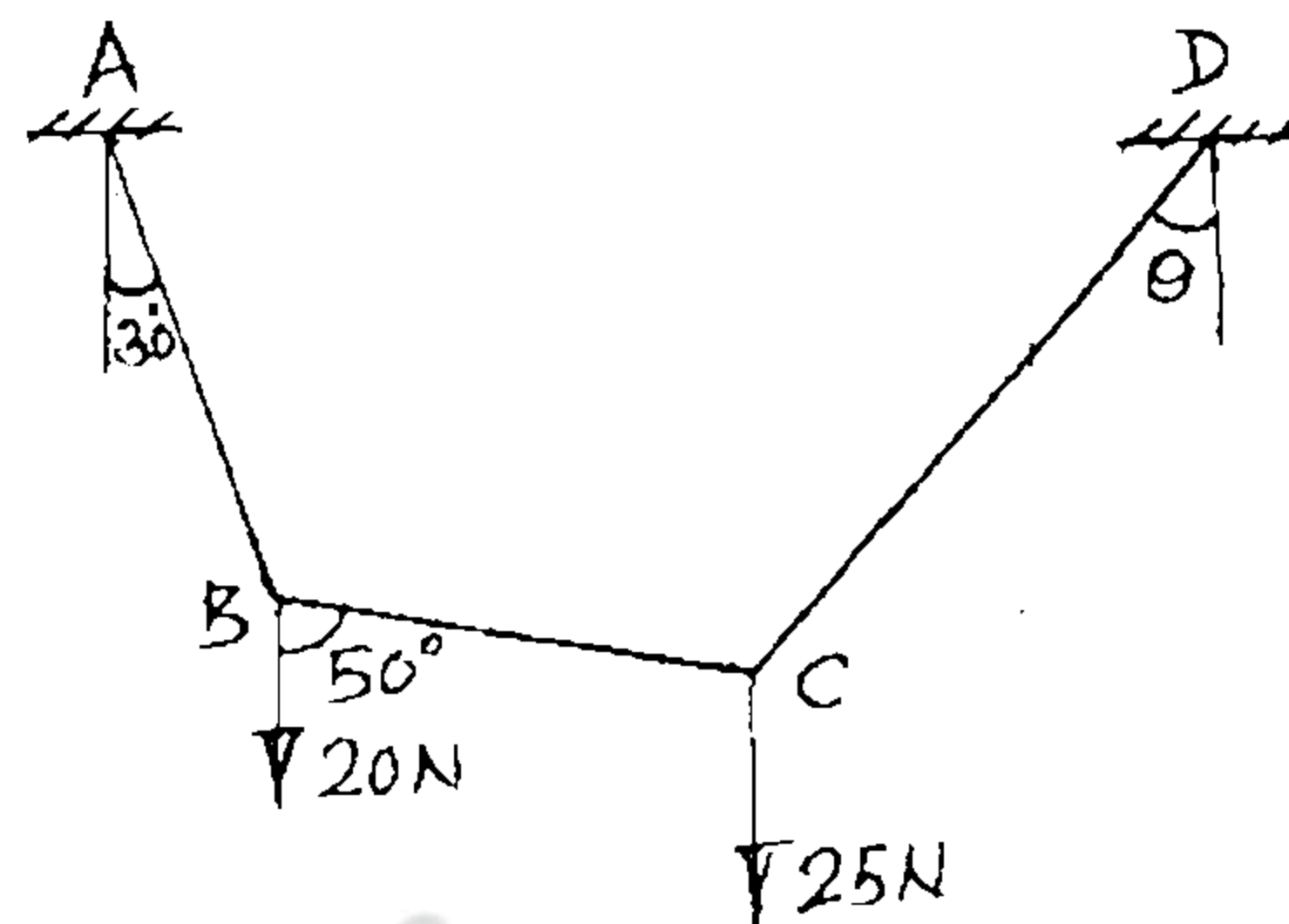
Fig. Q5 (b)

Fig. Q5 (c)

c. Determine the angle θ for the system of strings ABCD in equilibrium as shown in Fig. Q5 (c). **(10 Marks)**

6 a. Choose the correct answers for the following : **(04 Marks)**

i) Statically determinate beams are,
   A) The beams which can be analyzed completely using static equations of equilibrium
   B) The beams which can be without using static equations of equilibrium
   C) Fixed beams
   D) None of these

ii) Fixed beams are,
   A) One end is fixed and the other is simply supported
   B) Both ends are fixed
   C) Both ends are roller supported
   D) One end is fixed and the other is free.

iii) The number of reaction components at fixed end of a beam are,
   A) 2   B) 3   C) 4   D) None of these

iv) U.D.L. stands for
   A) Uniform dead load   B) Uniform distributed load
   C) Uniform door load   D) All of these

b. Explain different types of supports. **(06 Marks)**

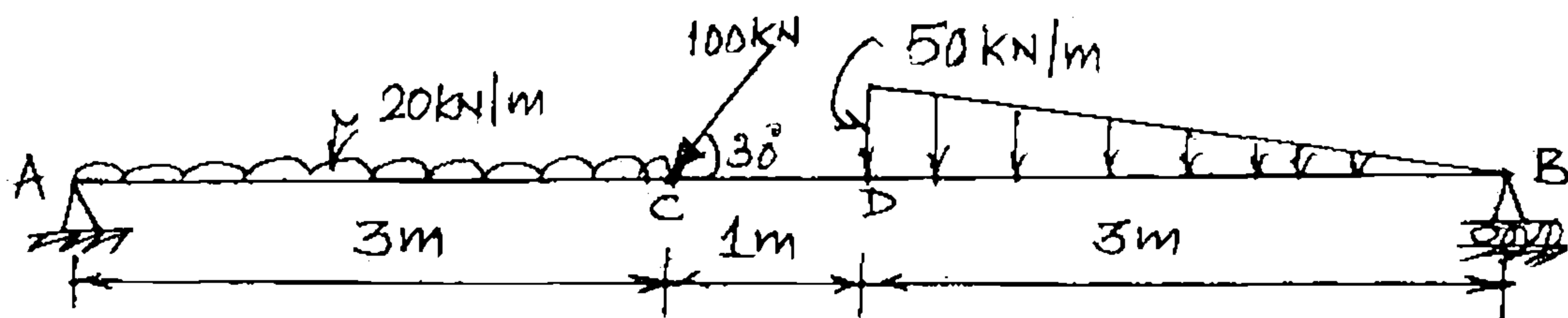c. Determine the reactions at the support for the beam shown in Fig. Q6 (c). **(10 Marks)**

Fig. Q6 (c)

7 **a.** Choose the correct answers for the following : **(04 Marks)**
    i) Angle of friction is angle between
      A) the incline and horizontal
      B) the normal reaction and friction force
      C) the weight of the body and the friction force
      D) Normal reaction and the resultant.
    ii) The force of friction developed at the contact surface is always
      A) Parallel to the plane and along the direction of the applied force
      B) Perpendicular to the plane
      C) Parallel to the plane and opposite to the direction of the motion
      D) All of these.
    iii) The maximum inclination of the plane on which the body free from external forces can repose is called
      A) Cone of friction   B) Angle of friction   C) Angle of repose   D) None of these
    iv) The force of friction depends on
      A) Area of contact
      B) Roughness of the surface
      C) Both area of contact and roughness of the surface
      D) None of these.

b. State the laws of static friction. **(04 Marks)**

c. A uniform ladder of length 15m and weight 750N rests against a vertical wall making an angle of 60° with the horizontal. Co-efficient of friction between the wall and the ladder is 0.3 and between the ground and the ladder is 0.25. A man weighing 500N ascends the ladder. How long will he be able to go before the ladder slips? **(12 Marks)**

8 **a.** Choose the correct answers for the following : **(04 Marks)**
    i) The unit of radius of Gyration is
      A) mm   B) mm^2 C) mm^3 D) mm^4
    ii) The moment of inertia of an area about an axis which is in a plane perpendicular to the area is called
      A) Radius of Gyration   B) Polar moment of inertia
      C) Second moment of area   D) None of these
    iii) The moment of inertia of a circle with 'd' as its diameter about its centroidal axis
      A) $\pi D^2/32$ B) $\pi D^2/64$ C) $\pi D^4/32$ D) $\pi D^4/64$
    iv) The moment of inertia of a square of side 'b' about an axis through its centroid is
      A) $b^4/12$ B) $b^4/8$ C) $b^4/36$ D) $b^3/12$

b. State and prove parallel axis theorem. **(06 Marks)**

c. Find the moment of inertia of the region shown in Fig. Q8 (c) about horizontal axis AB and also find the radius of Gyration about the same axis. **(10 Marks)**
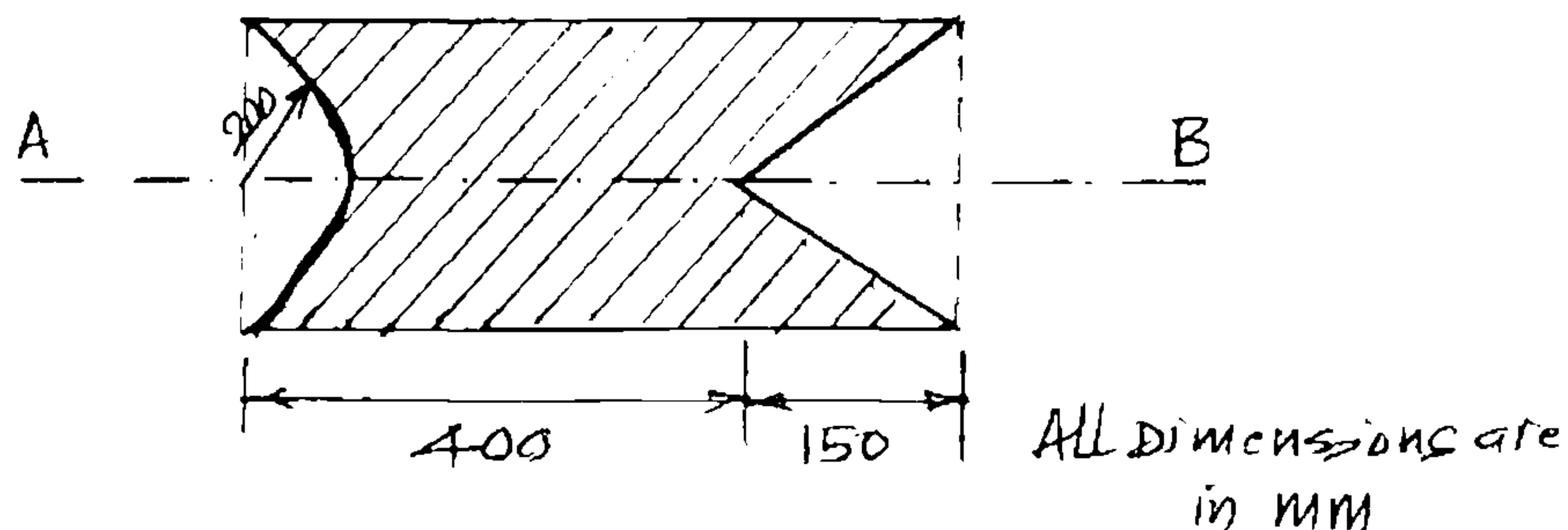

Fig. Q8 (c)