First / Second Semester B.E. Degree Examination

06 CIV 13 /23: Elements of Civil Engineering and Engineering Mechanics

Model Question Paper (Revised Syllabus)

Time: 3 Hours   Max Marks: 100

Note: Answer FIVE full questions choosing at least TWO from each Part

Part - A

1. a) Discuss briefly the impact of civil engineering infrastructure facilities on
        socio-economic development of a country.   05
    b) Briefly explain the scope of geotechnical engineering.   05
    c) Explain different types of roads.   06
    d) Distinguish between overflow and non-overflow dams.   04

2. a) Explain the following terms
        i) Particle.   ii) Continuum.   05
   b) State
        i) Principle of physical independence of forces
        ii) Principle of superposition of forces   05
  c) Three couples are acting on the brackets C, D and E attached to a bar AB as shown in the
     Fig 1. Determine the resultant moment due to these couples on the beam at A.   05
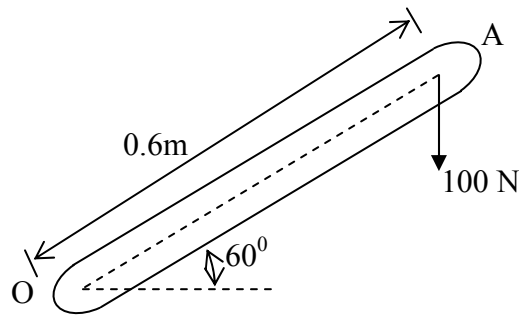

Fig. 1
All distances are in m
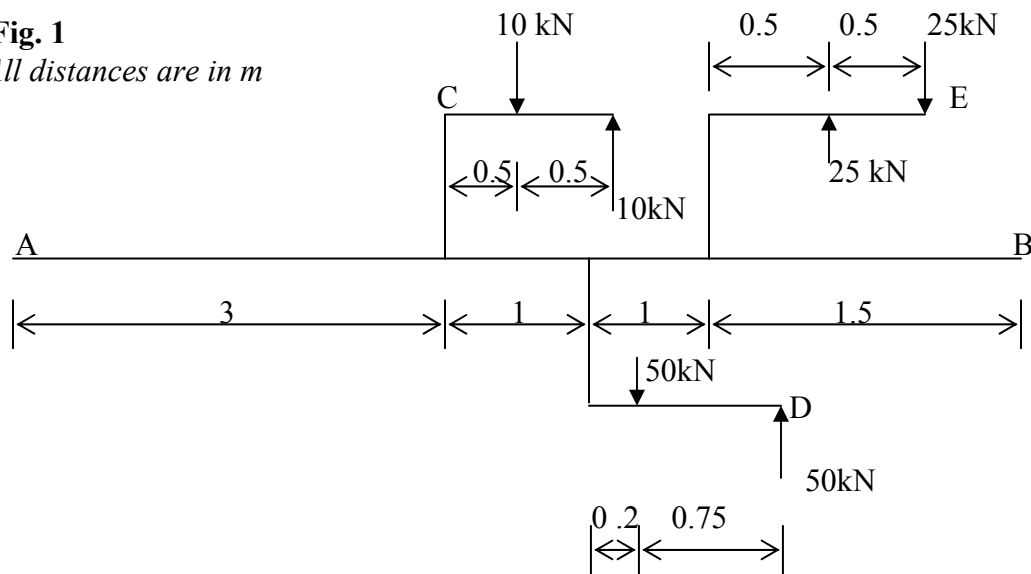
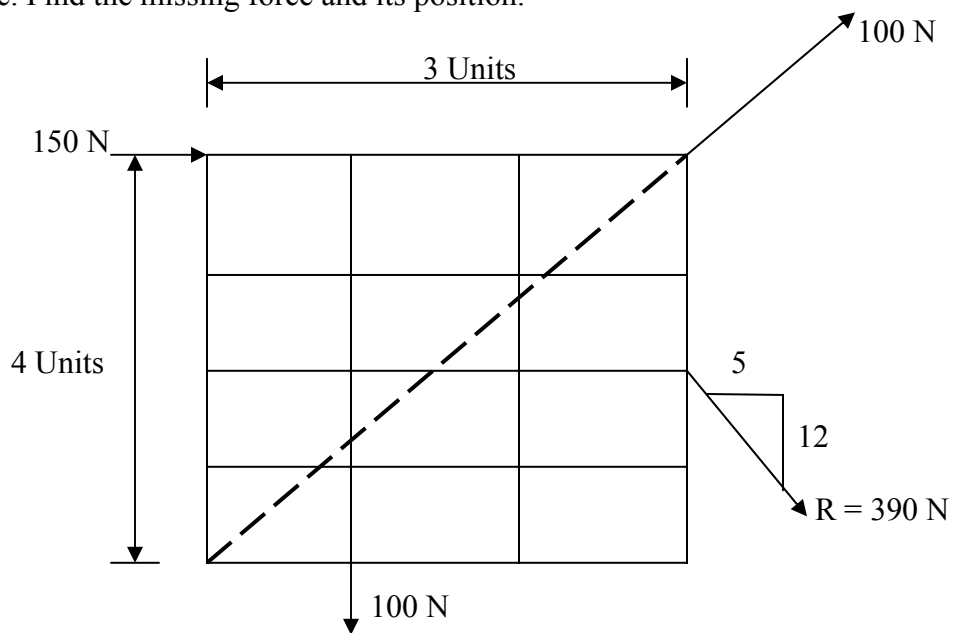d) A 100 N vertical force is applied on a shaft at A as shown in Fig 2. Determine the effect of 100 N force at O.   05
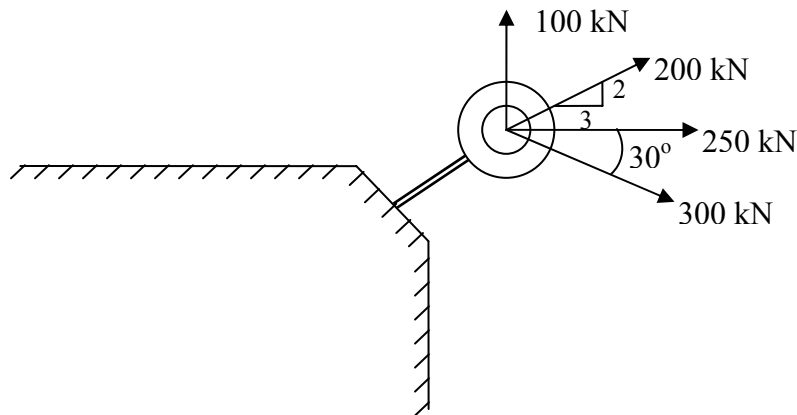

Fig. 2

3. a) The force 390 N shown in Fig. 3 is the resultant of four forces. Out of them, three are shown in the figure. Find the missing force and its position.   10

Fig. 3

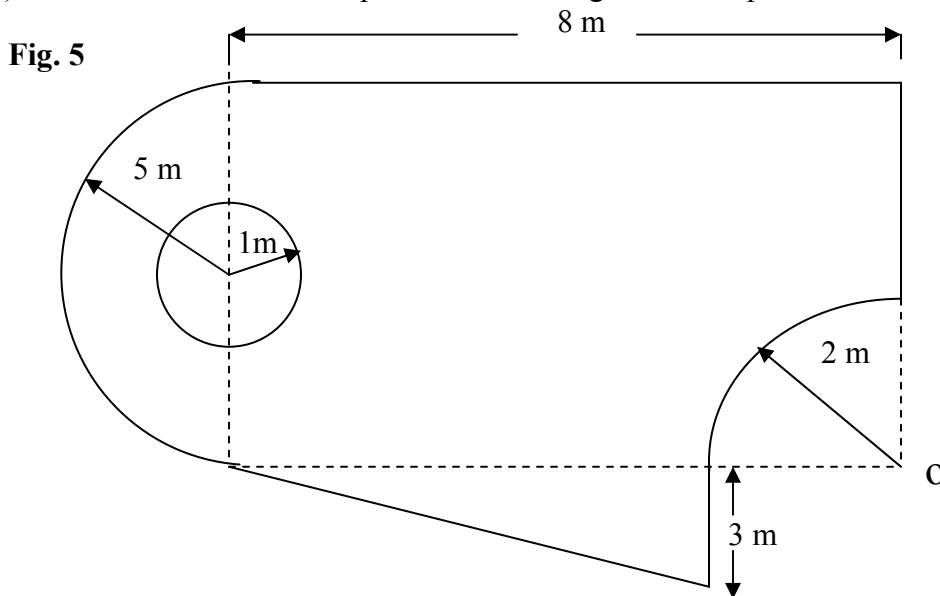b) Four forces are acting on a bolt shown in Fig 4. Determine the magnitude and direction of the resultant.   10
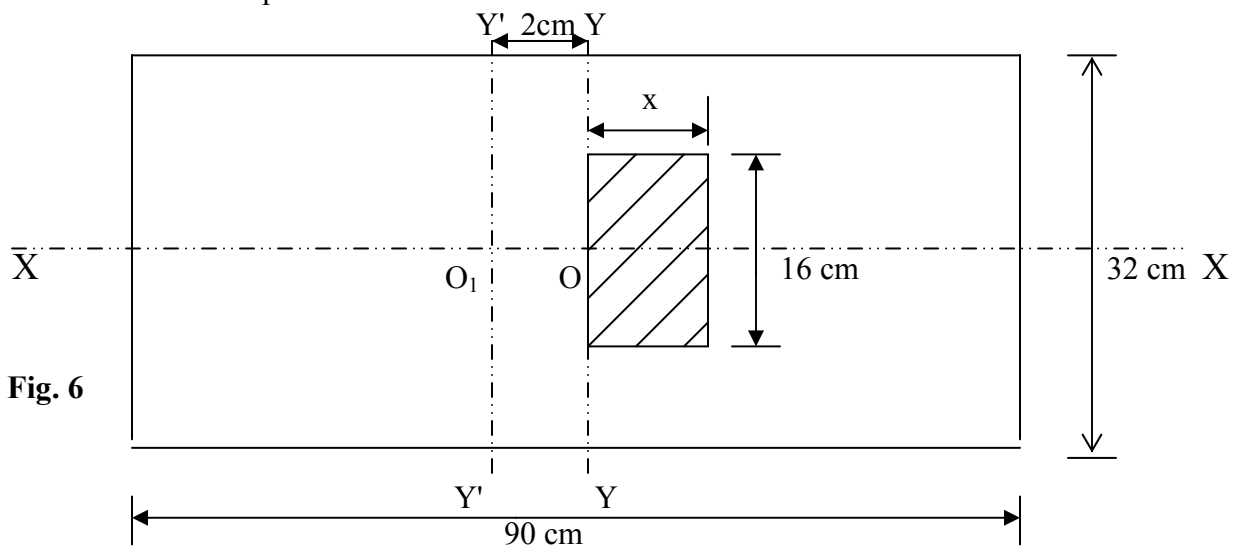

Fig. 4

4. a) Locate the centroid of a semicircular section using method of integration   05
   b) Locate the centroid of the plane shown in Fig. 5 with respect to 'O'.   09

Fig. 5

c) The centroid of a rectangle is to be shifted from O to O_1 (Refer Fig. 6). This is accomplished
   by removing the hatched portion, which is symmetrical about XX axis. Determine the area of
   the hatched portion   06

Fig. 6

Part – B

5. a) State and prove Lami's theorem   04
   b) State the equilibrium conditions for   04
      i) a system of coplanar concurrent forces
   ii) a system of coplanar non- concurrent forces

c) Determine the tensions in different parts of the string shown in Fig 7. Also find the values of W_1 and W_2 if the portion BC is horizontal. 12

Fig 7

120⁰ at E, 135⁰ at C, 4 kN hanging weight, W 1 at E, W 1 at C
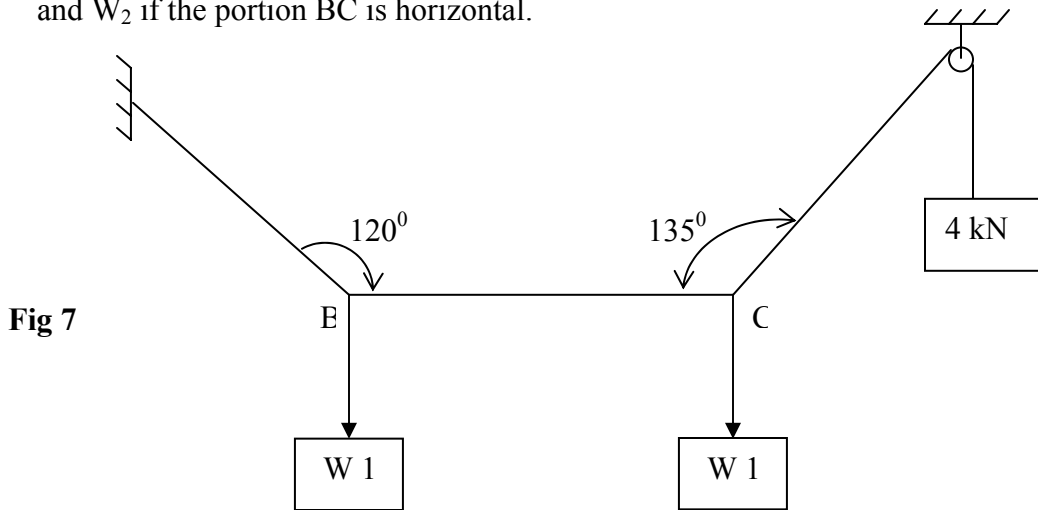
6. a) Write short notes on the following 06
    i) Determinate beams
    ii) Indeterminate beams
    b) Explain with neat sketches the following types of supports 06
    i) Roller support ii) Hinged support   iii) Fixed support
    c) Find the support reactions for the beam loaded as shown in Fig. 8 08

3kN   4 kN/m   2 kNm   5 kN 30^0 2 kN/m

A   B   C   D   E   F   **Fig 8**

| 1 m | 2m | 2m | 2m | 1m |
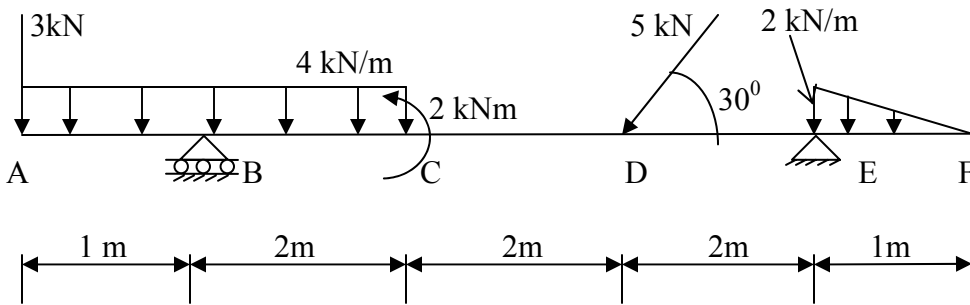
7. a) Define the following 06
    i) Angle of friction
    ii) Angle of Repose
    iii) Cone of friction
    b) A body of weight 200N is acted upon by a force of 40 kN as shown in Fig. 9. If the coefficient of friction between the inclined plane and the body is 0.3., check weather the body moves up the plane or down the plane or remains stationary 07

40 kN 20^0

Fig 9

35^0
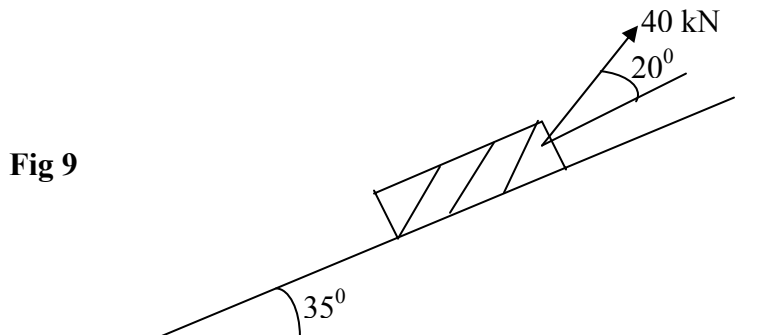
c) Find the force P on the wedge in the arrangement of block and wedge shown in Fig. 10 to cause the impending motion. Take $\mu = 0.3$ at all surfaces of contact.　　　　　07
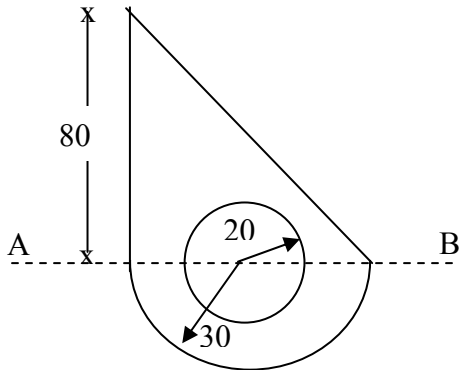
Fig 10

15°

3000 N

P

60°　Wedge
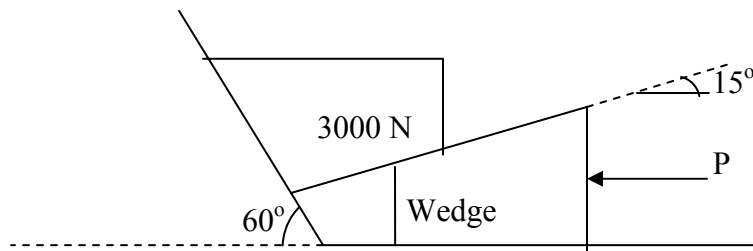
8. a) Write a note on second moment of area　　　　　05
   b) Obtain an expression for the moment of inertia of a rectangular section about its horizontal centroidal axis from first principle　　　　　05
   c) Compute the moment of inertia of the area shown in Fig. 11 about the axis A – B.　　　　　10

All dimensions are in mm

Fig. 11

X

80

A　　　20　　　B

30

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Note: Answer FIVE full questions choosing at least TWO from each Part

PART – A

1 a) Briefly explain the scope of following fields of civil engineering.
      i) Surveying ii) Water Resources Engineering   10
   b) With a neat sketch, explain the following components of the road.
      i) Pavement ii) Camber iii) Shoulder iv) Formation   06
   c) With a neat sketch, explain the following
      i) Skew bridge ii) Gravity dam.   04

2 a) What is a force? What are its characteristics?   05
   b) Write a note on principle of transmissibility of forces and its limitations.   05
   c) What is a couple? List its characteristics   05
   d) Reduce the force acting at A into a system of force and couple at point 'O'.
   (Refer Fig. 1)   05

Fig. 1
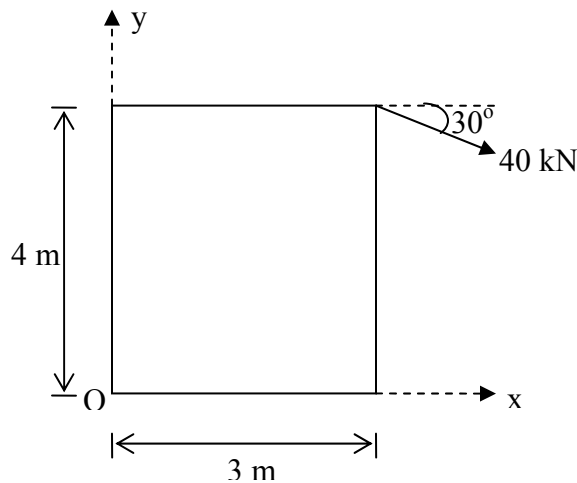
3 a) State and prove Varignon's theorem of moments.   05
   b) Define the terms
      i) Composition of a force system. ii) Resolution of force   05
   c) Find the magnitude, direction and distance of the resultant from the point A for the
      system of forces shown in Fig. 2.   10

Fig. 2
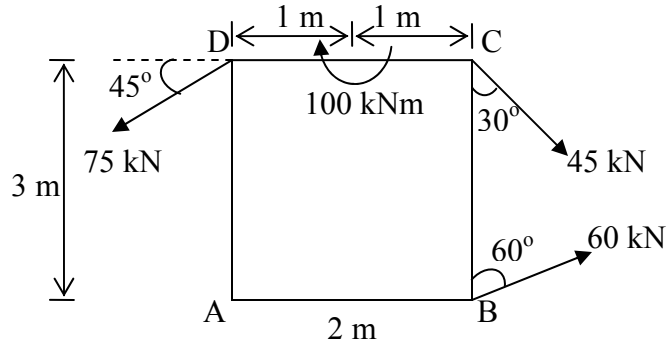
4 a) Locate the centroid of a triangle by the method of integration   08
   b) Determine the position of the centroid of the area shown in Fig. 3.   12
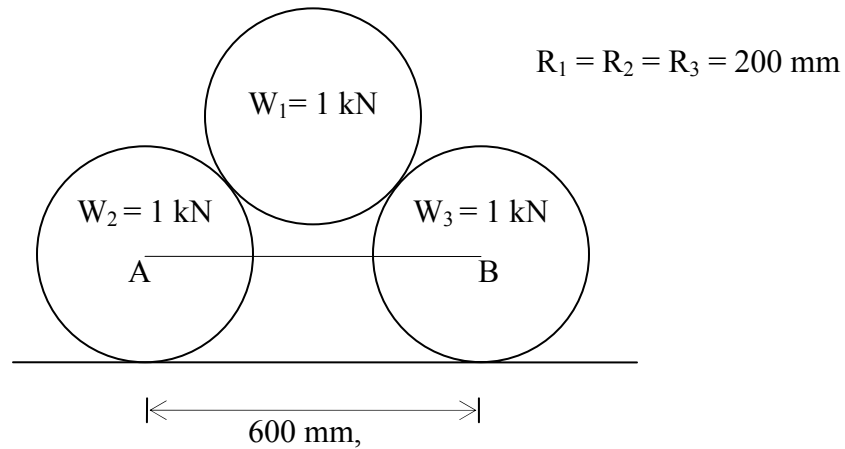

*All dimensions are in mm*

Fig. 3
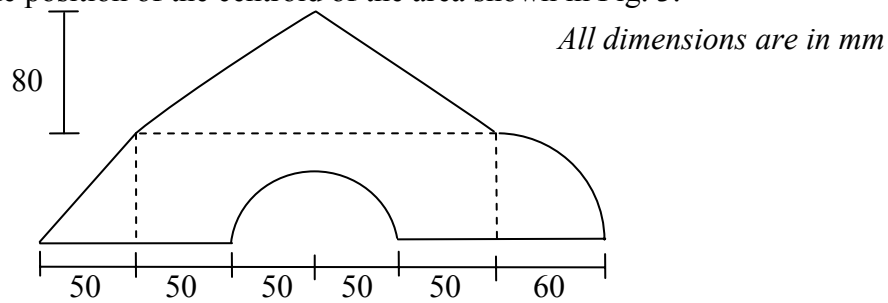
Part - B

5 a) Explain the following   08
   i) Free body diagram. ii) Equilibrium conditions. iii) Lami's theorem. iv) Equilibrant
   b) Determine the reactions at the surfaces of contact and tension in the string AB shown in Fig. 4.   12
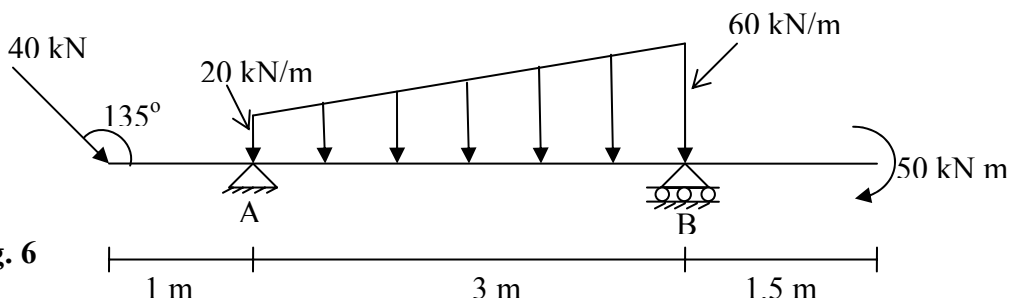

Fig. 4

$R_1 = R_2 = R_3 = 200$ mm

6 a) With neat sketches, explain various types of supports   05
   b) Write the free body diagrams of identical spheres A and B shown in Fig. 5.   05

Fig. 5
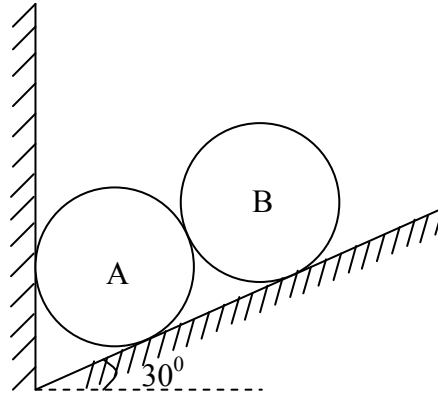
c) Determine the reactions at the supports A and B for a beam loaded as shown in Fig. 6

10

Fig. 6

| 1 m | 3 m | 1.5 m |

7   a) State the laws of static friction   05
    b) Show that angle of friction is equal to angle of repose   05
    c) Two blocks A and B connected by a horizontal link are supported on two rough planes as shown
       in Fig. 7. The coefficient of friction for the block A and the horizontal plane is 0.40. The angle
       of friction for block B on the inclined plane is 20^0. What is the smallest weight W_A of the block
       A for which the equilibrium of system can exist?

Fig. 7

10
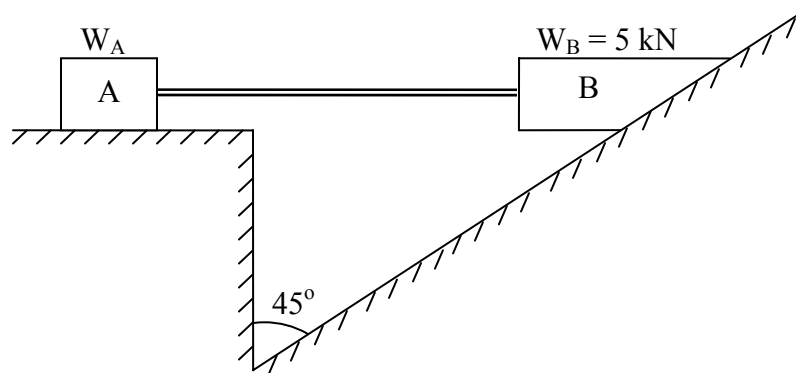
8   a) Write short notes on
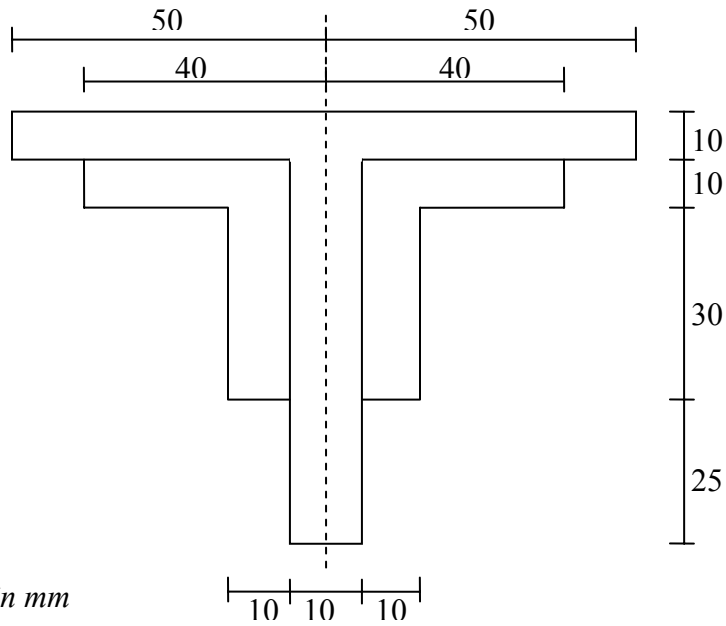   i) Polar moment of inertia. ii) Radius of gyration   05
    b) State and prove parallel axis theorem?   05

c) Compute the second moment of the built up area shown in Fig. 8 about its horizontal centroidal axis and find the corresponding radius of gyration.

Fig. 8

50   50

40   40

10
10
30
25

All dimensions are in mm

10   10   10

10

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