TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2082 Chaitra

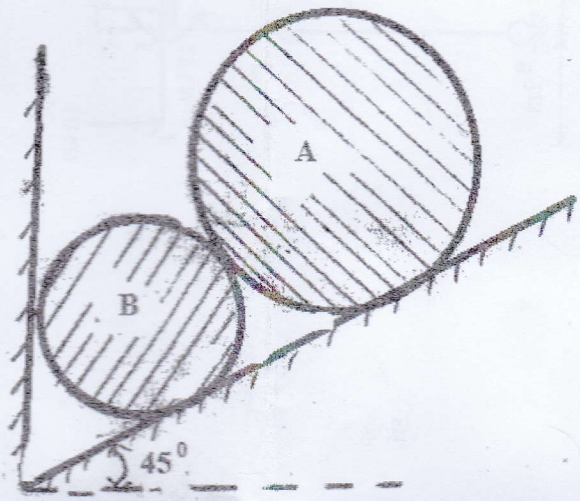
Exam.	Regular (New Course)		
Level	BE	Full Marks	60
Programme	BEL	Pass Marks	24
Year / Part	I / I	Time	3 hrs.

Subject: - Applied Mechanics *(ENCE 104)*

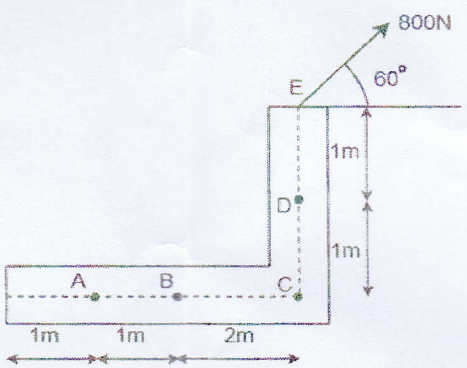
- ✓ *Candidates are required to give their answers in their own words as far as practicable.*
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. a) Describe the scope of mechanics. Define particle, rigid body and deformable body. [1.5+1.5]

   b) Calculate the reactions in all contact surfaces for figure given below. Given R_A = 7.5cm and R_B = 5cm. Also given that W_A = 200 N and W_B = 125 N. [5]

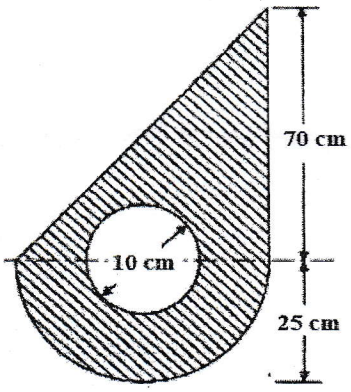


   c) Replace the given force of 800N at E with an equivalent system consisting of a vertical force at A and second force at D. [4]

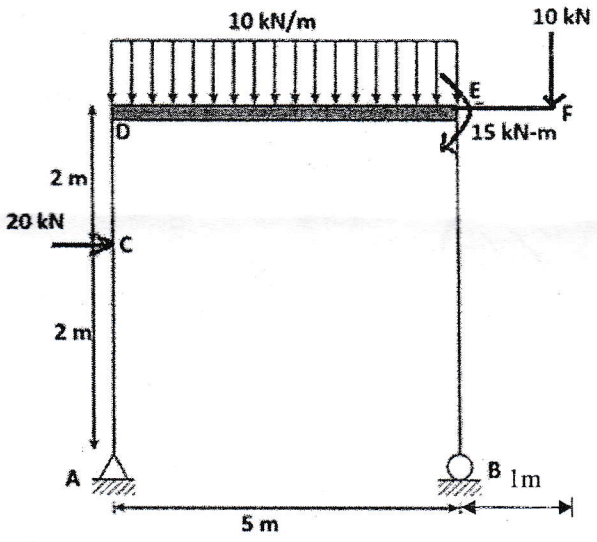


2. a) What is principle of transmissibility. Determine the area and centroid of the right-angled triangle using integration method. [2+3]

   b) Determine the moment of inertia of the section below about its centroidal axis and also calculate radius of gyration. [7]

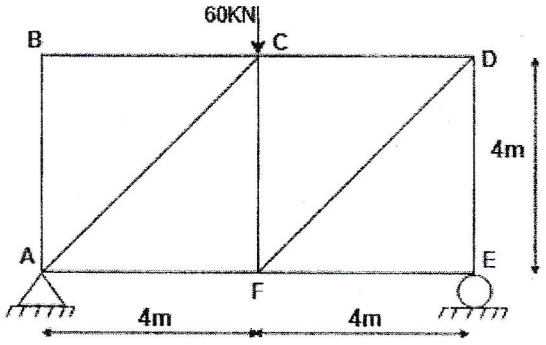


3. Calculate and draw the axial force, shear force and bending moment diagram with its salient features for the given frame as shown in figure below. [12]



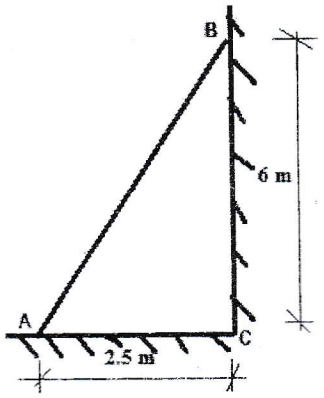
4. a) State and prove parallel axis theorem. [4]

   b) Discuss the advantages of truss structure. For the truss shown below determine the member forces in all the members. [2+6]



5. a) Define angle of friction and limiting friction. Discuss the various characteristics of static friction. [2+2]

b) Explain Varignon's Theorem. A 6.5 m ladder AB leans against a wall as shown in figure below. Assuming that the coefficient of static friction μ_s is the same at A and B, determine the smallest value of μ_s for which equilibrium is maintained. [1+7]



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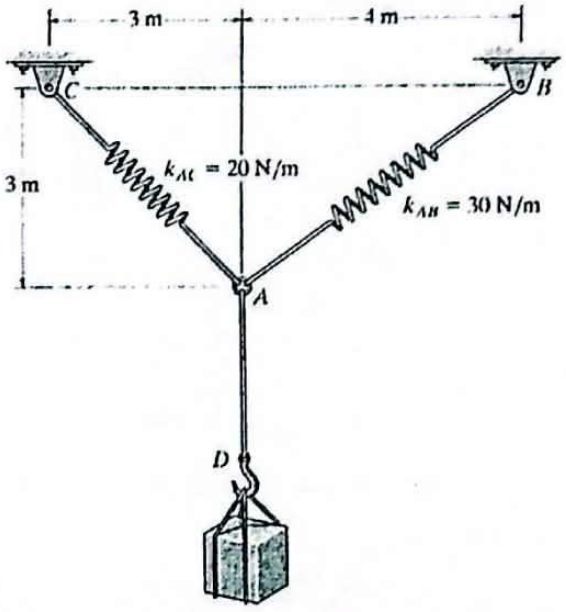
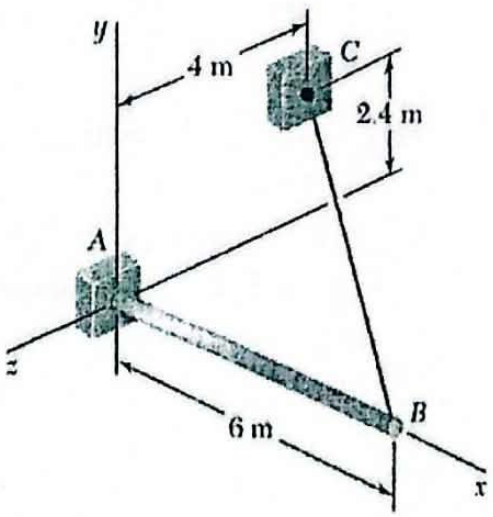
1. Define rigid body and deformable body. Explain the importance of drawing FBD in solving applied mechanics problem. Describe procedure to draw free body diagram with an example. [1+2+2]

2. Determine the stretch in springs AC and AB for equilibrium of the 2-kg block. The springs are shown in the equilibrium position. [4]



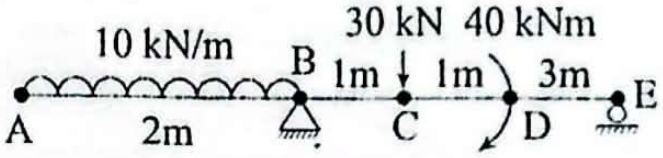
3. State Varignon's Theorem. The 6-m boom AB has a fixed end A. A steel cable is stretched from the free end B of the boom to a Point C located on the vertical wall. If the tension in the cable is 2.5 kN, determine the moment about A of the force exerted by the cable at B. [1+5]



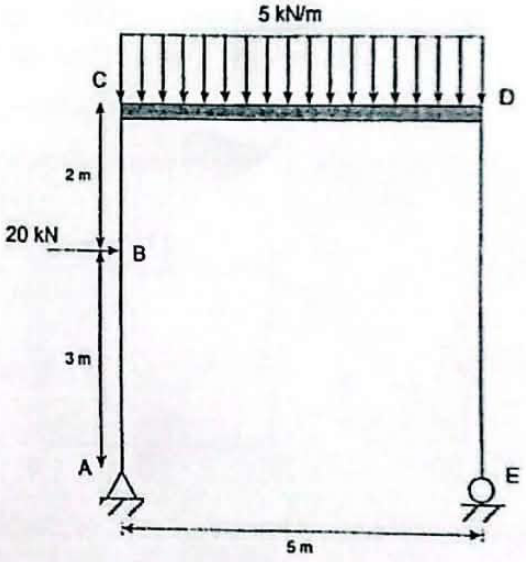
4. Define friction, impending motion and angle of friction. Write any four applications of friction. [3+2]

5. Define shear force and bending moment. Derive the relationship between shear force, load and bending moment. [2+4]

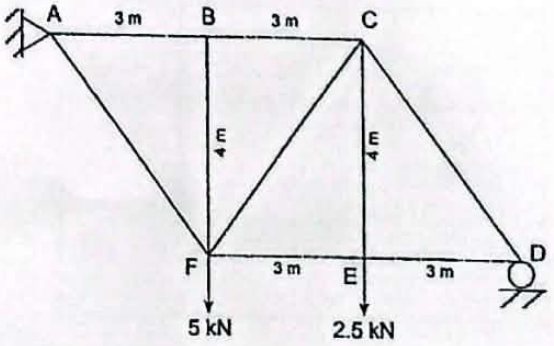
6. Draw SFD and BMD of the given beam. [8]



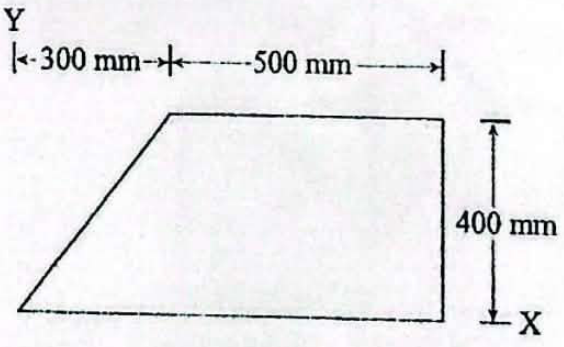
7. For the frame shown draw the axial force diagram, shear force diagram and bending moment diagram. Also mention the salient features (if any). [11]



8. Write assumptions of ideal truss. For the truss shown determine the member forces in all the members. [2+6]



9. Determine the moment of inertia about the centroidal x and y axis for given shaded section. [7]



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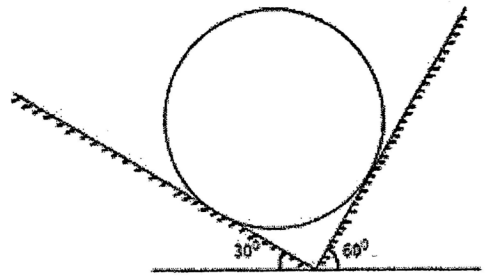
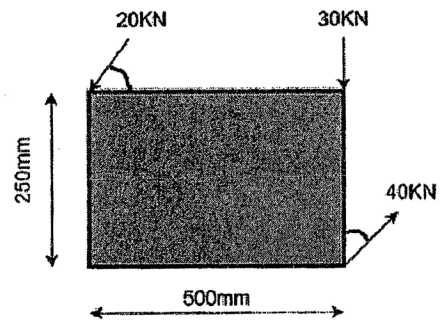
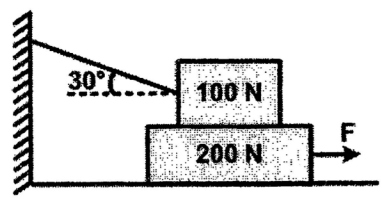
1. Differentiate between rigid body and deformable body. Define free body diagram and describe procedure to draw free body diagram with an example. [1+3]
2. A spherical ball of weight 100N, rests in a triangular groove whose sides are inclined at angles 30^0 and 60^0. Calculate the reactions at the surfaces of contact. [4]



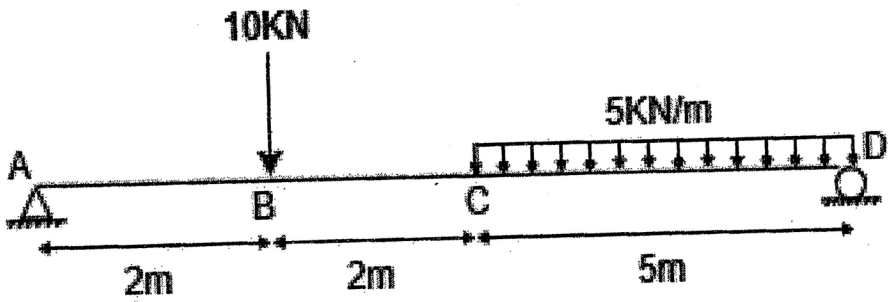
3. State the principle of transmissibility. In the rectangular plate shown, if the angle made by 20 kN force with the horizontal is 45° and angle made by 40 kN force with the vertical is 30°, determine the magnitude and line of action of the equivalent force. [1+5]



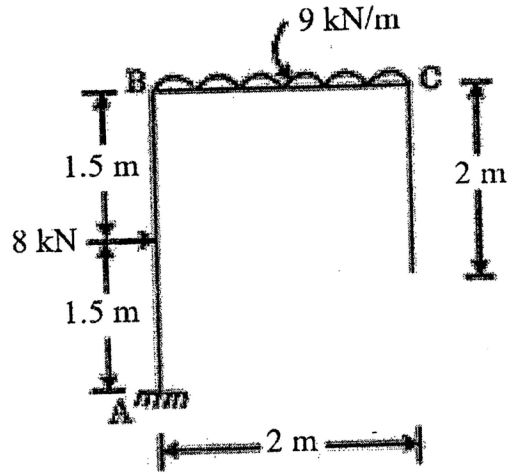
4. Define impending motion. If the coefficient of static friction for all surfaces is 0.3, determine the force F required to move the 200N weight to the right. [1+5]



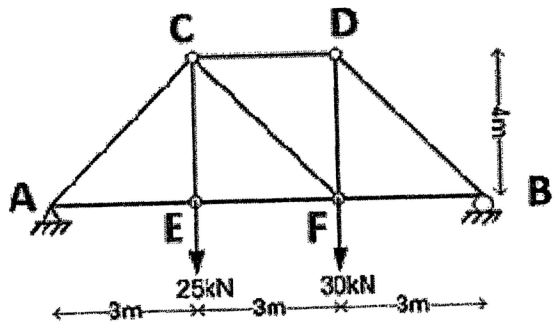
5. Define shear force and bending moment. Derive the relationship between shear force, load and bending moment. [2+4]
6. List out the different types of beams with sketches. Draw SFD and BMD of the given beam. [2+6]



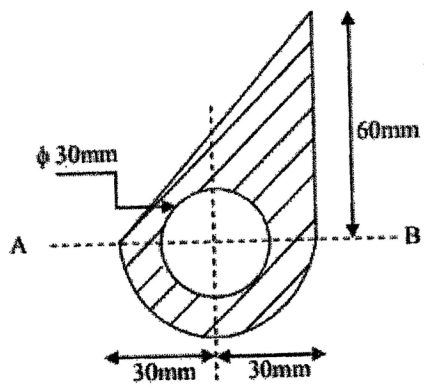
7. For the frame shown draw the axial force diagram, shear force diagram and bending moment diagram. Also mention the salient features if any. [11]



8. Write assumptions of ideal truss. For the truss shown determine the member forces in all the members. [2+6]



9. Determine the moment of inertia about the centroidal x and y axis for given section. [7]



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Year / Part	I / I	**Time**	3 hrs.

Subject: - Applied Mechanics (*CE 104*)

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- ✓ *Attempt **All** questions.*
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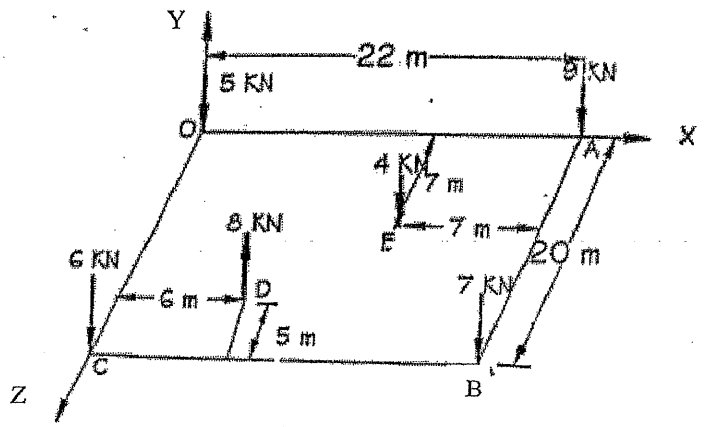
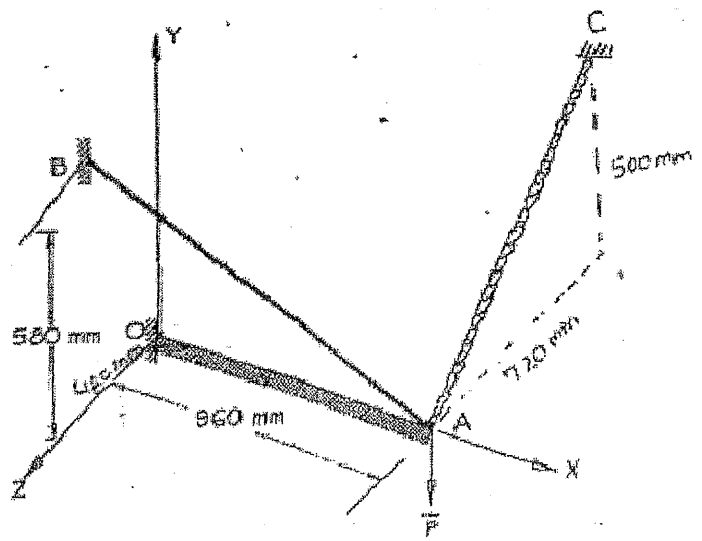
1. a) Explain the basic principles of mechanics. [2]

   b) Determine the magnitude and direction of the resultant of the following forces (all pull) acting at a point: [4]
   (i) 30 N due North (ii) 42 N, 30° North of West (iii) 54 N, 65° West of South
   (iv) 27 N due East and (v) 18 N South-East

2. a) "Moment of force does not characterize the point of application of force along its line of action". Justify with suitable examples. A concrete slab supports six vertical loads as shown in figure. Determine the resultant of these forces and the point through it acts. [2+5]

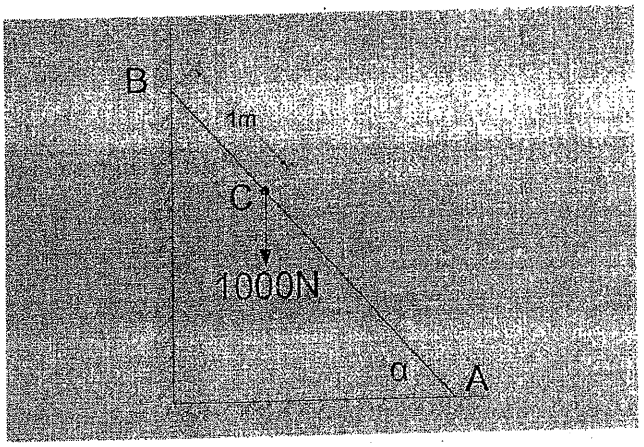


   b) The beam OA carries a load P and is supported by two cables as shown. Knowing that the tension in cable AB is 732 N and that the resultant of the load P and of the forces exerted at A by the two cables must be directed along OA, determine the tension in cable AC, resultant and the load P. [5]

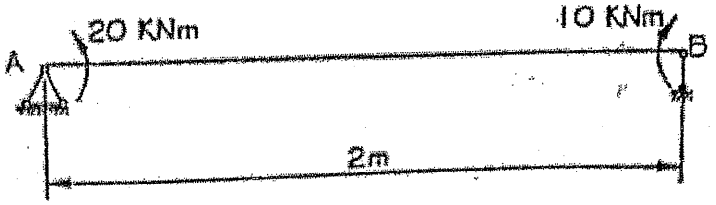


3. a) Explain four different conditions of equilibrium and motion when a rigid body acted upon by a force is in contact with the surface. [2]

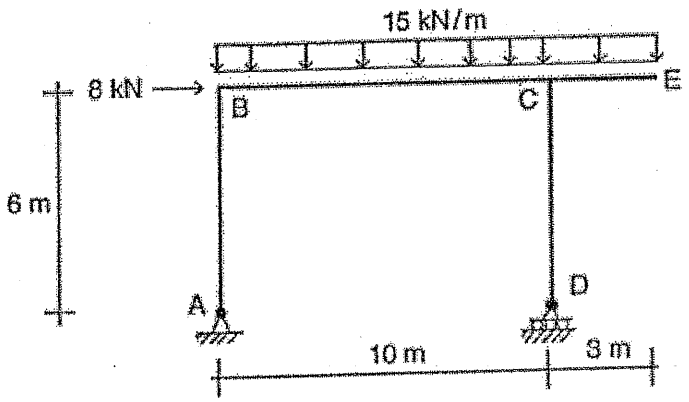
b) A ladder shown in figure is 4m long and is supported by a horizontal floor and vertical wall. The coefficient of friction at the wall is 0.25 and at the floor is 0.5. The weight of the ladder is 200N. The ladder supports a vertical load of 1000N at C. Compute least value of α at which the ladder may be placed without sliding to right. [4]



4. a) What do you mean by analysis and design of structure? Draw bending moment diagram for the beam shown. [2+4]

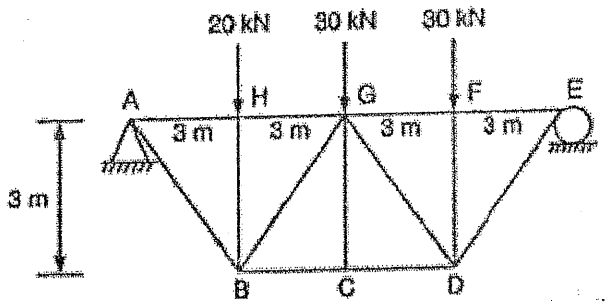


b) Draw axial force, shear force and bending moment diagram for the frame as shown in figure. Indicate salient points, if any. [11]



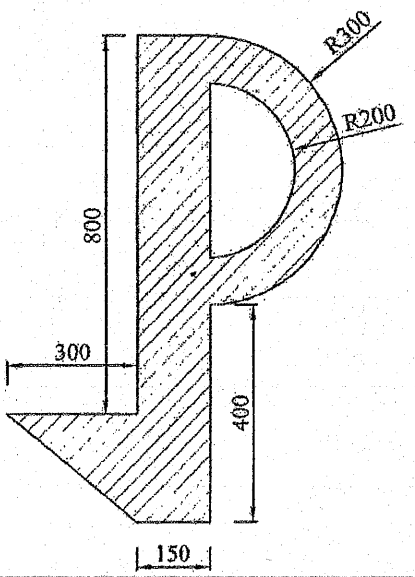
5. a) Explain with diagrams perfect, imperfect and redundant truss. [3]

b) Determine force developed in members HG, BG, BC, CG& DG. [6]



6. a) Determine the centroid of a rectangle by method of integration. [3]

b) Determine moment of inertia of a shaded lamina about centroidal y-axis. All dimensions are in mm. [7]



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