ES101

[ET]

END SEMESTER EXAMINATION : JAN. 2022

ENGINEERING MECHANICS

Time : 3 *Hrs.*   *Maximum Marks* : 60

Note: *Attempt questions from all sections as directed.*
Use of scientific calculator is allowed.

SECTION – A   (24 Marks)

*Attempt any **four** questions out of **five**.*
*Each question carries **06** marks.*

1. Determine the resultant of the four forces tangent to the circle of radius 3m shown in figure 1. What will be its location with respect to the center of the circle?
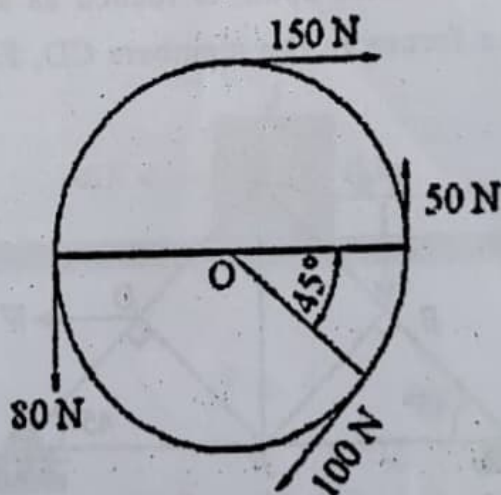

Fig. 1

P.T.O.

2. Two blocks A and B, connected by a horizontal rod and frictionless hinges are supported on two rough planes as shown in Fig 2. The coefficients of friction are 0.3 between block A and the horizontal surface, and 0.4 between block B and the inclined surface. If block B weighs 100 N, what is the smallest weight of block A, that will hold the system in equilibrium?
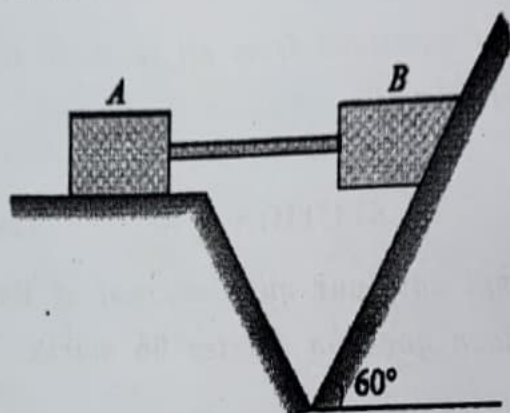

Fig. 2

3. A truss of 8 meters span, is loaded as shown in Fig 3. Find the forces in the members CD, FD and FE of the truss.
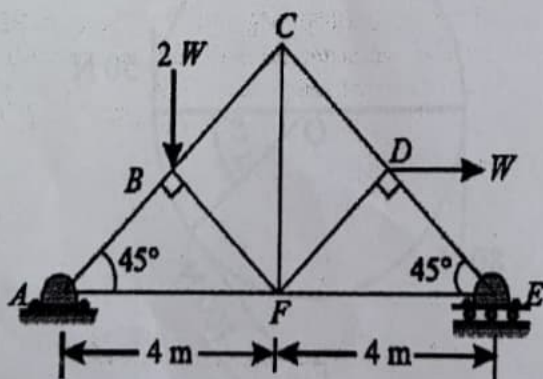

Fig. 3

(I-65)

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4. Apply Pappus-Guldinus theorem to derive :

    (i) Volume of the sphere of radius r.

    (ii) Centroid of Semicircular arc of radius r.

    (iii) Area of the surface of revolution obtained by revolving a quarter circular arc of radius r.

5. Two bodies A and B of mass 80 kg and 20 kg are connected by a thread and move along a rough horizontal plane under the action of a force 400 N applied to the first body of mass 80 kg as shown in Fig. 4. The coefficient of friction between the sliding surfaces of the bodies and the plane is 0.3. Determine the acceleration of the two bodies and the tension in the thread, using D' Alembert's principle.
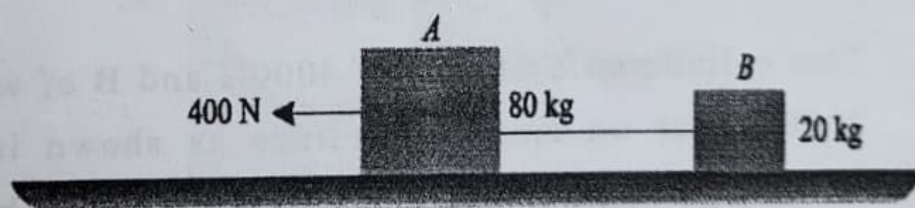

Fig. 4

SECTION – B   (20 Marks)

Attempt any **two** questions out of **three**.

Each question carries **10** marks.

6. What do you understand by point of contra-flexure? Explain with suitable fig. A simply supported beam of length 6 m carries point load of 3 kN and 6 kN at distances of 2 m and 4 m from the left end as shown in Fig. 5. Draw the shear force and bending moment diagrams for the beam.
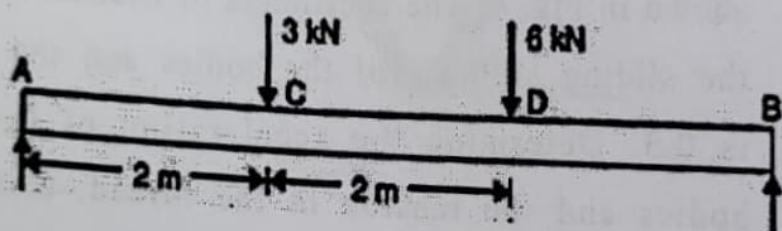

Fig. 5

7. Two cylinders, A of weight 4000N and B of weight 2000N rest on smooth inclines as shown in the following figure 6. They are connected by a bar of negligible weight hinged to each cylinder at its geometric center by smooth pins. Find the force P to be applied as shown in figure 6 such that it will hold the system in the given position.
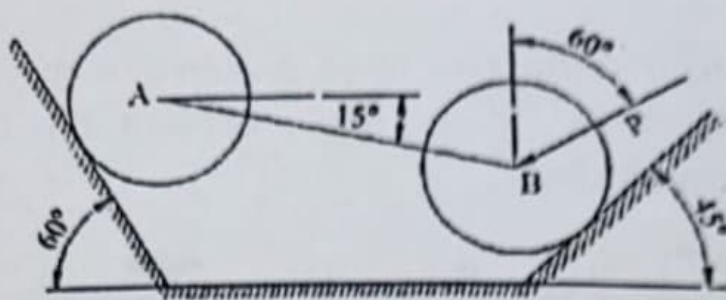
Fig. 6

8. Find the moment of inertia of a hollow section shown in Fig. 7 about an axis passing through its centre of gravity and parallel horizontal axis.
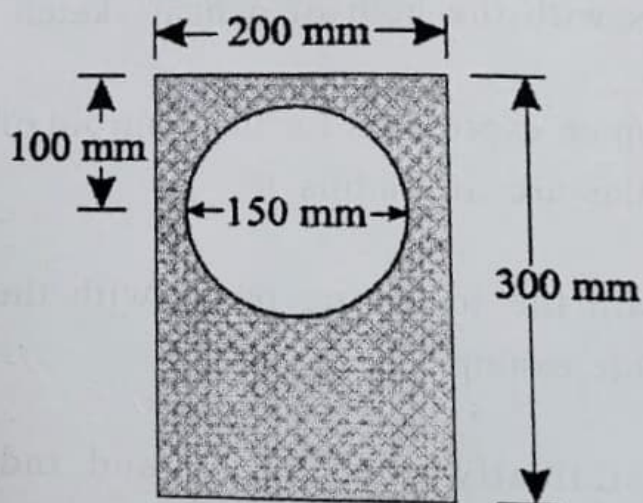

Fig. 7

SECTION – C   (16 Marks)

(Compulsory)

9. (a) Identify the zero-force member in the truss as shown in fig. 8. Also, explain the logic of identification.   (4)
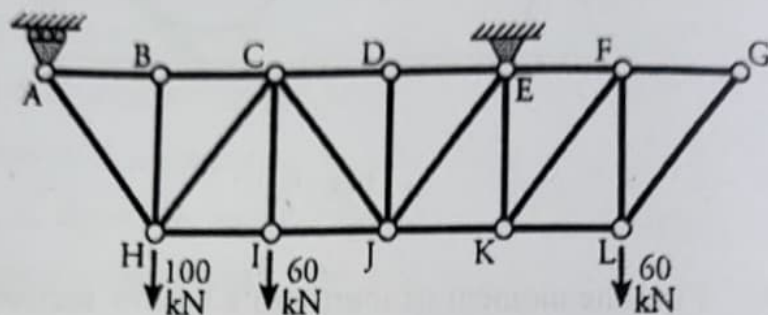

Fig. 8

(b) Prove the parallel and perpendicular axis theorem in the determination of the moment of inertia of areas with the help of a neat sketch.   (4)

(c) Set up an expression for the centroid of the quarter circular arc of Radius R.   (4)

(d) Explain the following terms with the help of a suitable example.

(i) Statically determinate and indeterminate beams.

(ii) Polar Area Moment of Inertia.   (4)