Course Code: ESC106A
Course Title: Construction Materials and Engineering Mechanics

Lecture No. 42:
Problems on Centre of gravity and Moment of Inertia

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Lecture Intended Learning Outcomes

At the end of this lecture, students will be able to:

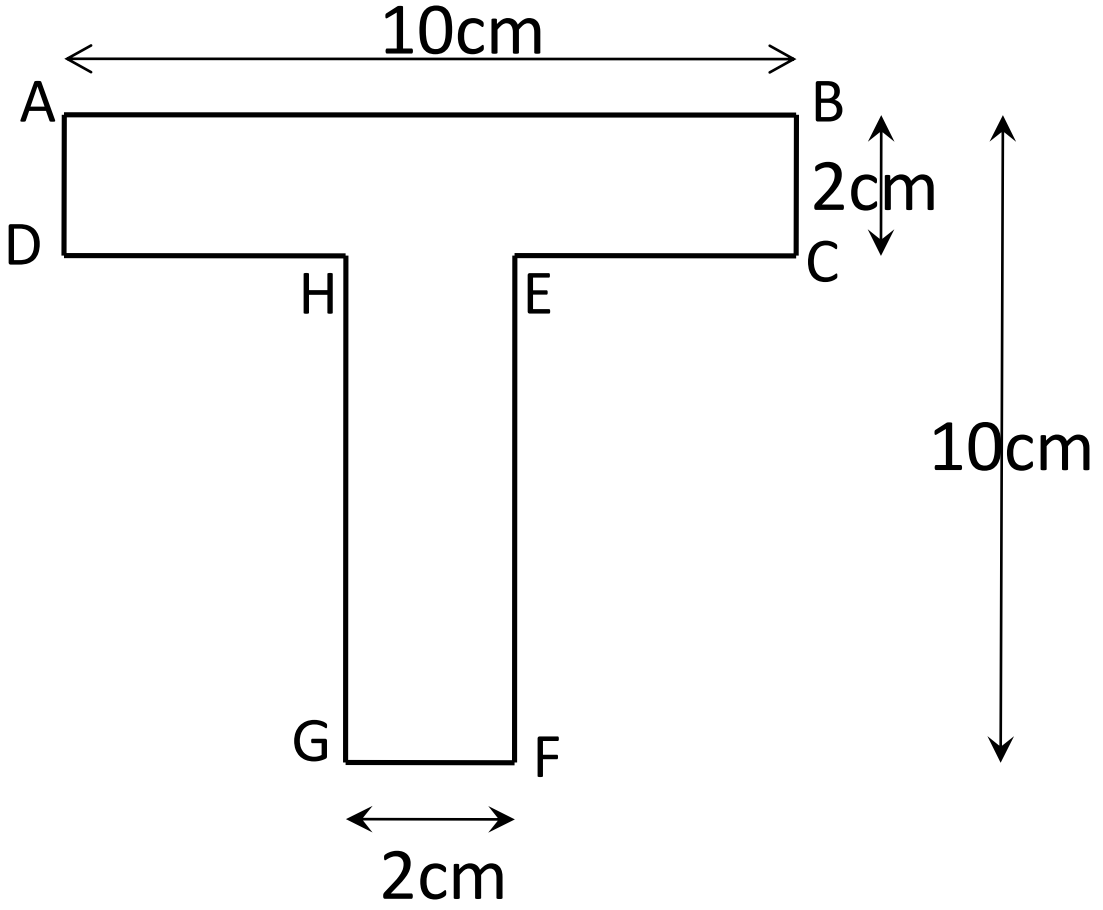
- Calculate the co-ordinates of the centroid of the composite section by breaking into simple regular areas
- Solve for the Moment of Inertia of sections with respect to the considered axis
- Apply parallel axis theorem to obtain the MI of the sections

Contents

Problems on center of gravity and moment of Inertia

Problems on CG and MI

1.Determine the moment of inertia of the given section about the horizontal and vertical axes passing through the centre of gravity of the section.



Solution:

Step 1. Determine centroidal axis of the section

Step 2. Apply parallel axis theorem and obtain the MI of the simple composite areas with respect to the CG axis

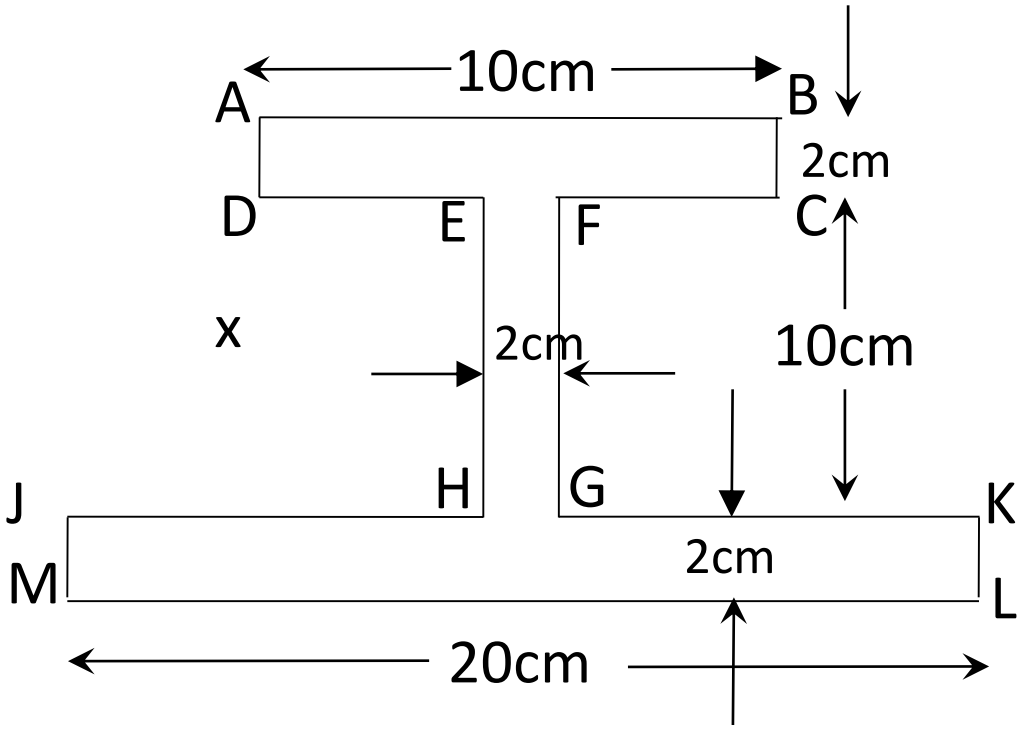
$Ans:$

$I_{XX} = 314.24cm^4$

$I_{YY} = 172.00cm^4$

Problems on CG and MI

2. Determine the moment of inertia of the given section about the centroidal axis X-X perpendicular to the web.



Solution:

Step 1. Determine centroidal axis of the section by determining the co-ordinates of CG

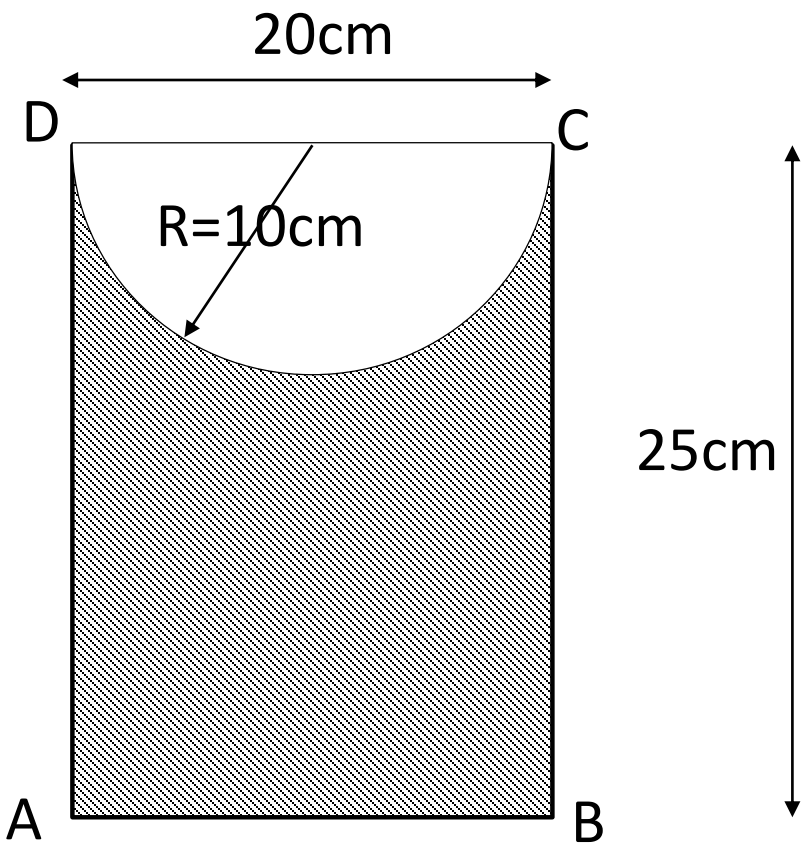
Step 2. Apply parallel axis theorem and obtain the MI of the simple composite areas with respect to the CG axis.

$Ans:$

$$I_{XX} = 2166.66cm^4$$

Problems on CG and MI

3. Find the MI of the area shown shaded in the figure about base AB.

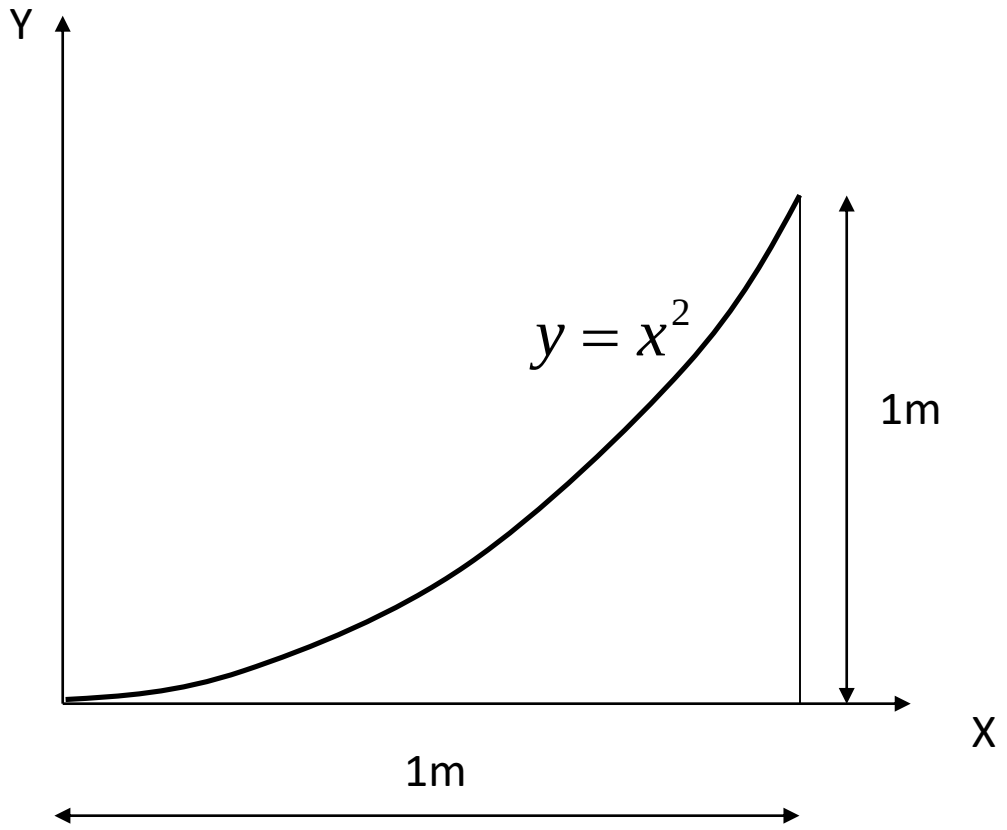


$Ans:$

$I_{AB} = 32{,}533 cm^4$

Problems on CG and MI

4. Locate the centroid of the area given.

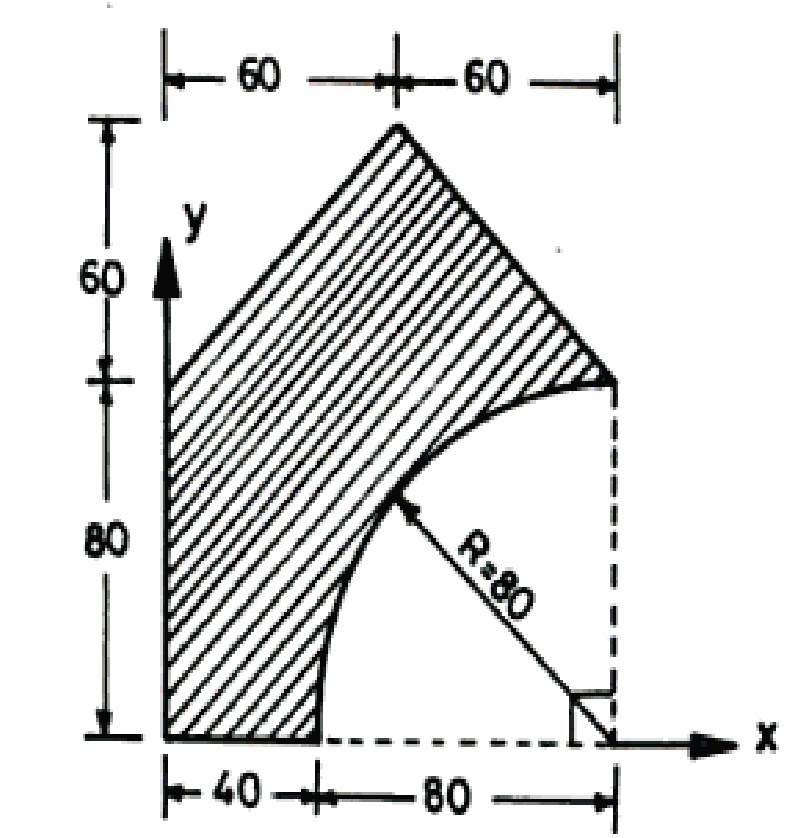


$$\bar{x} = \frac{3}{4} m$$

$$\bar{y} = \frac{3}{10} m$$

Problems on CG and MI

5. Locate the centroid of the shaded area given.

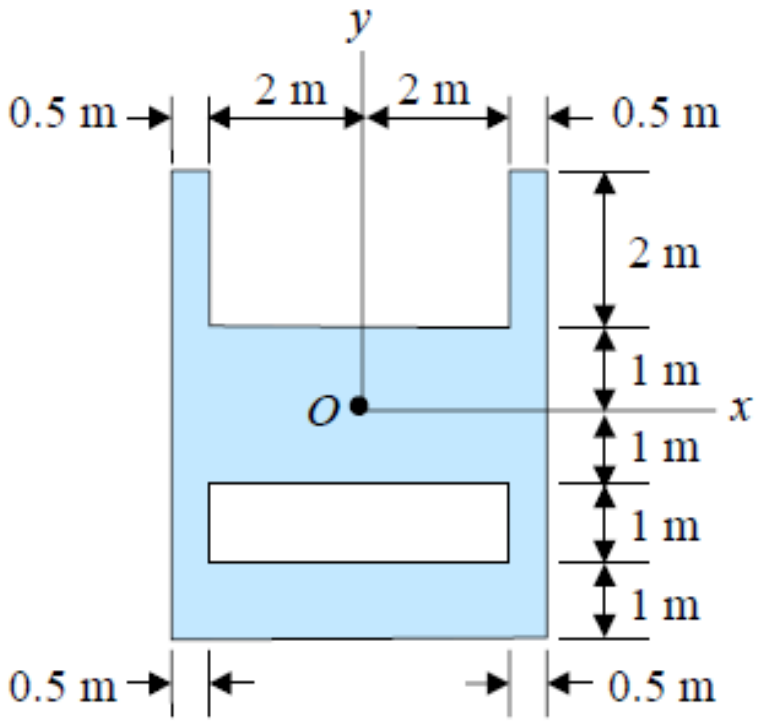


$$\bar{x} = 44cm$$

$$\bar{y} = 70.12cm$$

Problems on CG and MI

6. Locate the centroid of the area given.



$$\bar{x} = 2.5m$$

$$\bar{y} = 2.44m$$

Summary

- The composite areas are divided into simple areas and the coordinates of the centre of gravity are determined
- Integration method is adopted to find out the centre of gravity for irregular shapes
- Parallel axis theorem is applied to find out the MI of the section