# CheggSolutions - Thegdp

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## Subject: Engineering Mechanics

### Topic: Moment of Inertia Calculation

**Problem:** Calculate the moment of inertia for the I section with respect to the centroidal vertical axis.

**Given Information and Introduction:**

- There is an I-shaped cross section with dimensions provided:
  - Flange width: 200 mm
  - Flange thickness: 50 mm
  - Web height: 300 mm
  - Web thickness: 50 mm
- The moment of inertia **(I_y)** with respect to the vertical centroidal axis needs to be computed.

**Solution Steps:**

##### Step 1: Calculate the Moment of Inertia of Each Rectangle

To find the moment of inertia **(I_y)** of the entire I-section with respect to the centroidal vertical axis, the structure can be divided into three rectangles: one web and two flanges. The standard formula for the moment of inertia about the centroidal axis for a rectangle is:

```
I_y = \frac{1}{12} b h^3
```

- **b** is the width
- **h** is the height

Consider the plates:

1. Top Flange
2. Bottom Flange
3. Web

##### Step 2: Moment of Inertia of the Web

- Width **(b) = 50 mm**
- Height **(h) = 300 mm**

The moment of inertia for the web:

```
I_{\text{web}} = \frac{1}{12} \times 50 \times 300^3

I_{\text{web}} = \frac{1}{12} \times 50 \times 27000000

I_{\text{web}} = 112500000 \, \text{mm}^4
```

**Explanation:** The moment of inertia of the web is calculated using the standard formula for a rectangle. The width and the height of the web are taken as given.

##### Step 3: Moment of Inertia of Each Flange

- Width **(b) = 200 mm**
- Height **(h) = 50 mm**

The moment of inertia for each flange:

```
I_{\text{flange}} = \frac{1}{12} \times 200 \times 50^3

I_{\text{flange}} = \frac{1}{12} \times 200 \times 125000

I_{\text{flange}} = 2083333.33 \, \text{mm}^4
```

**Explanation:** Each flange has its moment of inertia calculated using the standard rectangle formula. The width and height are taken for each flange.

##### Step 4: Combined Moment of Inertia

Since the flanges are symmetrical about the centroid, sum the moments of inertia of the web and the flanges:

```
I_y = I_{\text{web}} + 2 \times I_{\text{flange}}

I_y = 112500000 + 2 \times 2083333.33

I_y = 112500000 + 4166666.66

I_y = 116666666.66 \, \text{mm}^4

I_y \approx 117 \times 10^6 \, \text{mm}^4
```
```

**Explanation:** The combined moment of inertia of the I-section is found by summing the moment of inertia of the web and twice the moment of inertia of one flange. This accounts for both the top and bottom flanges.

**Final Solution:**

The moment of inertia **(I_y)** of the I-section with respect to the centroidal vertical axis is approximately:

```
\boxed{117 \times 10^6 \, \text{mm}^4}
```